

NASA SP-7011 (354)
October 1991

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH
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NASA SP-7011 (354)

October 1991

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration
Office of Management
Scientific and Technical Information Program
Washington, DC
1991

INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 225 reports, articles and other documents originally announced in September 1991 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

<i>STAR</i> (N-10000 Series)	N91-25100 — N91-27119
<i>IAA</i> (A-10000 Series)	A91-40567 — A91-44484

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1991 will be published in early 1992.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

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TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED
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ACCESSION NUMBER →	N91-10591* # Good Samaritan Hospital and Medical Center, Portland, OR. Neurological Sciences Inst.	← CORPORATE SOURCE
TITLE →	ROLE OF ORIENTATION REFERENCE SELECTION IN MOTION SICKNESS Semiannual Status Report	
AUTHORS AND PUBLICATION DATE →	ROBERT J. PETERKA and F. OWEN BLACK Sep. 1990 37 p	
CONTRACT NUMBER →	(Contract NAG9-117)	← AVAILABILITY SOURCE
REPORT NUMBERS →	(NASA-CR-186612; NAS 1.26:186612) Avail: NTIS HC/MF A03	← PRICE CODE
COSATI CODE →	CSCL 06E	

Three areas related to human orientation control are investigated:
 (1) reflexes associated with the control of eye movements and posture;
 (2) the perception of body rotation and position with respect to gravity;
 and (3) the strategies used to resolve sensory conflict situations which arise when different sensory systems provide orientation cues which are not consistent with one another or with previous experience. Of particular interest is the possibility that a subject may be able to ignore an inaccurate sensory modality in favor of one or more other sensory modalities which do provide accurate orientation reference information. This process is referred as sensory selection. This proposal will attempt to quantify subject's sensory selection abilities and determine if this ability confers some immunity to the development of motion sickness symptoms.

Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED
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ACCESSION NUMBER →	A91-12594* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.	← CORPORATE SOURCE
TITLE →	CREW SUPPORT FOR AN INITIAL MARS EXPEDITION	
AUTHORS →	YVONNE A. CLEARWATER (NASA, Ames Research Center, Moffett Field, CA) and ALBERT A. HARRISON (California, University, Davis) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 43, Nov. 1990, p. 513-518. refs	← AUTHORS' AFFILIATION
	Copyright	← JOURNAL TITLE
		← PUBLICATION DATE

Mars crews will undergo prolonged periods of isolation and confinement, travel unprecedented distances from earth and be subjected to formidable combinations of hardships and dangers. Some of the biomedical, psychological and social challenges of the first manned Mars expedition are reviewed and means of aligning humans, technology and space habitats in the interests of mission success are identified.

Author

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 354)

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LIFE SCIENCES (GENERAL)

A91-42049

RESPONSE OF THE MAUTNER NEURONS OF THE GUPPY TO RETURN TO TERRESTRIAL CONDITIONS AFTER A STAY IN WEIGHTLESSNESS [REAKTSIIA MAUTNEROVSKIKH NEIRONOV GUPPI NA VOZVRASHCHENIE V ZEMNYE USLOVIA POSLE PREBYVANIIA V NEVESOMOSTI]

D. A. MOSHKOV, L. N. SAVEL'EVA, and E. A. OIGENBLIK (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 317, no. 2, 1991, p. 495-498. In Russian. refs

Copyright

As part of the Aquarium program, an investigation was made of the morphofunctional aspects of the response of Mautner neurons to the return of the fish *Poecilia reticulata* to terrestrial conditions after a prolonged stay (up to 14 days) in weightlessness on Cosmos-2044 and on the Mir station. It is shown that the return to earth and the initial period of readaptation to the usual terrestrial gravity after a prolonged stay in space, which is accompanied by dysfunction of the vestibular system, lead to extremely harmful disorders of the morphofunctional state of the central neurons responsible for the regulation of motion and under the control of the vestibular system.

L.M.

A91-42308

PROTECTIVE EFFECTS OF ADAPTATION AND SOME PERSPECTIVES FOR THE DEVELOPMENT OF ADAPTATION MEDICINE [ZASHCHITNYE EFFEKTY ADAPTATSII I NEKOTORYE PERSPEKTIVY RAZVITIIA ADAPTATSIONNOI MEDITSINY]

F. Z. MEERSON (AMN SSSR, Nauchno-Issledovatel'skii Institut Obshchei Patologii i Patologicheskoi Fiziologii, Moscow, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 22, Apr.-June 1991, p. 52-89. In Russian. refs

Copyright

This paper discusses the architecture of the 'systemic structural vestige' (SSV) of adaptation to periodic hypoxia. It is shown that some protective cross-over effects of such adaptation can be used in treatments of allergies and psychological and neuropathological disorders. Special attention is given to the SSV architecture during adaptation to repeated stress effects. A new phenomenon is described, termed the phenomenon of the adaptive stabilization of structures (PASS), which is manifested in the improved resistance of isolated organs, cells, and subcellular structures to autolysis; thus it was shown that PASS protects the heart tissue from ischemic necrosis. It is shown that the PASS can be reproduced without the application of stress using electropuncture.

I.S.

A91-42323

LIPID PEROXIDATION IN PLANTS WITH VARIOUS LEVELS OF ORGANIZATION UNDER MICROGRAVITY STRESS [PEREKISNOE OKISLENIE LIPIDOV RASTENII RAZLICHNOGO UROVNIA ORGANIZATSII PRI MIKROGRAVITATSIONNOM STRESSE]

V. A. BARABOI, S. I. ZHAD'KO, E. L. KORDIUM, and P. G. SIDORENKO (AN USSR, Institut Botaniki, Kiev, Ukrainian SSR) Akademiia Nauk SSSR, Izvestia, Seria Biologicheskaja (ISSN 0002-3329), May-June 1991, p. 368-375. In Russian. refs

Copyright

The dynamics of changes in the intensity of lipid peroxidation (LPO) was investigated in several plant systems, including cultured cells of *Chorella* and *Haplopappus gracilis* and pea and wheat sprouts, developing under conditions of clinostasis or microgravity. It was found that the dynamics of LPO under these conditions is characterized by an early decrease of the LPO intensity followed by an induction. The amplitudes of the oscillatory and antioxidation activities of the LPO system were found to be higher in plants with higher organization levels.

I.S.

A91-42324

THE STATE OF THE THYROID AND THE LIPID METABOLISM IN THE GROUND SQUIRREL CITELLUS PARRYI DURING HIBERNATION [TIREOIDNYI STATUS I OBMEN LIPIDOV U SUSLIKA CITELLUS PARRYI PRI GIBERNATSII]

A. G. LAPINSKII and Z. G. NEVRETDINOVA (AN SSSR, Institut Biologicheskikh Problem Severa, Magadan, USSR) Akademiia Nauk SSSR, Izvestia, Seria Biologicheskaja (ISSN 0002-3329), May-June 1991, p. 398-409. In Russian. refs

Copyright

The role of the thyroid in the lipid metabolism of the Arctic ground squirrel during hibernation was investigated by monitoring changes in the morphological characteristics and in thyroid hormone levels in hibernating animals and correlating these changes with the concentrations of cholesterol and phospholipids in blood plasma. It was found that, throughout the hibernation period, blood concentrations of thyroid hormones were elevated and the cellular morphology of the gland exhibited changes indicating high glandular activity; these changes paralleled increases in plasma concentrations of cholesterol and phospholipides (including an increase in unsaturated fatty acids) and a decrease of cholesterol/phospholipid molar ratio in plasma membranes.

I.S.

A91-43237

PERFORMANCE RECOVERY FOLLOWING +GZ-INDUCED LOSS OF CONSCIOUSNESS

JOHN W. BURNS, PAUL M. WERCHAN, JOHN W. FANTON, and ANDREW B. DOLLINS (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 615-617.

Copyright

The recovery of the ability to perform tasks following G-induced loss of consciousness (G-LOC) is investigated in animal subjects. Seven male baboons are trained in a shock-avoidance task which involves turning off a red light in 1 s which appears at 2-s intervals. The 1-s shock can either be avoided completely by responding immediately when the subject sees the red light or shortened by a late trigger pull. G-LOC is induced by 4 or 6 G/s exposure to 8

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+Gz until G-LOC is observed by means of three transcranial electrodes used to observe EEG. The time between the onset of EEG and the ability to perform the task is the measured performance-recovery time. Absolute incapacitation time averages 11 s for the baboons compared to 12 s measured in previous tests for human subjects. Recovery time decreases as the number of G-LOC exposures increases and increases as the time of unconsciousness increases. The baboon is concluded to be an effective subject for the study of G-LOC. C.C.S.

A91-43694

ROLE OF THE SYMPATHETIC NERVOUS SYSTEM IN COLD-INDUCED HYPERTENSION IN RATS

PAULA E. PAPANKE, CHARLES E. WOOD, and MELVIN J. FREGLEY (Florida, University, Gainesville) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 71, July 1991, p. 300-306. refs

(Contract NIH-HL-39154-04; NIH-HL-23689; NIH-HD-20098)

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Changes in blood pressure, baroreceptor, and sympathetic nervous system (SNS) activities were investigated in chronically cannulated, unanesthetized, and unrestrained rats exposed chronically to cold. The subjects of the study were twenty male rats that were prepared with indwelling catheters in the femoral artery and vein. The results obtained show that systolic, diastolic, and mean blood pressures of cold-exposed rats were increased to levels significantly above those of controls. The sensitivity of the baroreflex (delta heart period/delta mean arterial pressure) was increased in cold-treated rats. The concentration of norepinephrine in plasma increased after 24 hours of exposure to cold and remained elevated throughout the experiment. The data obtained are considered to prove the hypothesis that a neurogenic component may have a role in the development and maintenance of cold-induced hypertension. O.G.

N91-25566# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Hauptabt. fuer Strahlenschutz.

CS-137 SOIL TO PLANT TRANSFER STUDIES AND THEIR IMPLICATIONS ON PARAMETERS USED IN THE AUSTRIAN VERSION OF ECOSYS

MARTIN H. GERZABEK, OTHMAR HORAK, and KONRAD MUECK Nov. 1990 11 p Presented at EC-Workshop on Transfer of Radionuclides in Natural and Semi-Natural Environments, Passariano, Italy, 11-15 Sep. 1989 Submitted for publication Sponsored by Austrian Ministry of Science and Research

(OEFZS-4563; ETN-91-99494) Copyright Avail: NTIS HC/MF A03

In 1987 and 1988 102 Cs-soil to plant transfer data were determined in the field for various crop plants. The obtained mean values range from 0.0004 (zucchini, cauliflower) to 0.059 (rye straw). In addition to the significant influence of plant species on the transfer value, great differences between vegetative and generative parts were observed. The Cs-transfer into grains of cereals was 1.6, 1.8, 4.2 and 10.5 times lower than into straw of rye, barley, wheat and corn, respectively. The activity ratio between potato tops and tubers was 5.0. Multiple logarithmic correlation analysis proved the Cs-concentration of the soil to have the highest influence on the Cs-transfer as compared to physical and chemical soil properties. Therefore, the Cs-transfer seems not to be a constant for different fallout levels. On pasture a significant negative correlation between the potassium supply and Cs-uptake into grass was obtained. Data on transfer parameters used for the Austrian version of the radioecological model ECOSYS 87 are presented and discussed. ESA

N91-25567# Oak Ridge National Lab., TN.

NON-DESTRUCTIVE MONITORING OF MICROBIAL BIOFILMS AT SOLID-LIQUID INTERFACES USING ON-LINE DEVICES

D. E. NIVENS, J. Q. CHAMBERS, and D. C. WHITE (Tennessee Univ., Knoxville.) 1990 12 p Presented at the International Congress on Microbially Influenced Corrosion, Knoxville, 7-12 Oct.

1990

(Contract DE-AC05-84OR-21400)

(DE91-010777; CONF-9010138-3) Avail: NTIS HC/MF A03

Corrosion, biofouling, and related problems have been an impetus for investigating interactions between microorganisms and solid surfaces. In recent years, a number of studies have been performed to assess the damages caused by microbial influenced corrosion (MIC). In a number of these studies, electrochemical techniques have monitored the performance of metal surfaces exposed to bacteria. However, most of these methods can only indirectly detect the presence of biofilms. In this paper, two non-destructive on-line monitoring devices, attenuated total reflection Fourier transform infrared spectroscopy (ATR-FT/IR) and the quartz crystal microbalance (QCM) were used to directly monitor biofilm formation. These devices have been developed to study the initial fouling process and subsequent biofilm development and not merely the effects of the living film on the host material. The ATR-FT/IR technique provides information about biomass, exopolymer production, and the nutritional status of microbial biofilms. The QCM provides a direct measure of biomass. ATR-FT/IR and QCM detect 10(exp 6) and 10(exp 4) *Caulobacter crescentus* cells/sq cm, respectively. Both techniques can be coupled with electrochemical methods for deeper insight into mechanisms of MIC. DOE

N91-25568# Mount Sinai School of Medicine, New York, NY.

MOLECULAR MECHANISMS IN RADIATION DAMAGE TO DNA

R. OSMAN 1990 29 p

(Contract DE-FG02-88ER-60675)

(DE91-010922; DOE/ER-60675/T2) Avail: NTIS HC/MF A03

This study concentrated on two major directions. One was to investigate the formation and the properties of sugar and base radicals with quantum mechanical methods. The other was to explore with molecular dynamics simulations the conformational properties of radiation damaged DNA. Details of the findings highlight the approaches taken and identify the major contributions to the understanding of molecular processes in the development of biological consequences of the depositions of radiation energy in DNA. DOE

N91-25569# Georgia Univ., Athens. Dept. of Biochemistry.

THE METABOLISM OF HYDROGEN BY EXTREMELY THERMOPHILIC BACTERIA

M. W. W. ADAMS 1991 9 p

(Contract DE-FG09-88ER-13901)

(DE91-011031; DOE/ER-13901/3) Avail: NTIS HC/MF A02

The novel archaeobacterium, *Pyrococcus furiosus*, grows optimally at 100 C by a fermentative metabolism and produces hydrogen (H₂). This organism appears to ferment glucose and evolve H₂ by a novel pathway. The following metalloenzymes and proteins involved in H₂ metabolism were purified and characterized: hydrogenase (NiFeS), ferredoxin (FeS), pyruvate ferredoxin oxidoreductase (FeS), and a new enzyme which contains tungsten, glyceraldehyde ferredoxin oxidoreductase (WFeS). A rubredoxin was also purified, and it and the ferredoxin have been sequenced. In addition, a second new enzyme was identified, glucose ferredoxin oxidoreductase. These represent the first enzymes and proteins to be purified from any organism able to grow optimally above 90 C. All are remarkably thermostable and show maximal catalytic activity greater than 95 C. The ferredoxin has several unique properties and is potentially an extremely thermostable model for the catalytic sites of a variety of mesophilic metalloenzymes. In addition, the FeS-containing enzymes, hydrogenase and pyruvate ferredoxin oxidoreductase, and a ferredoxin, have been purified from the most thermophilic eubacterium currently known, *Thermotoga maritima*. This organism grows up to 90 C, also by fermentation. The hydrogenases of *T. maritima* and *P. furiosus* each have many unique properties in comparison with mesophilic hydrogenases, and both appear to contain new types of metal centers that are specifically adapted to catalyze H₂ production at the extreme temperatures. Hydrogenase activity has also been measured in four other extremely thermophilic organisms, one of which is capable of growth at 120 C. DOE

N91-25570*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

REGENERABLE BIOCIDES DELIVERY UNIT Patent Application
GERALD V. COLOMBO, inventor (to NASA), CLIFFORD D. JOLLY, inventor (to NASA) (Umpqua Research Co., Myrtle Creek, OR.), and RICHARD L. SAUER, inventor (to NASA) 18 Mar. 1991 18 p
(NASA-CASE-MS-21763-1; NAS 1.71:MS-21763-1; US-PATENT-APPL-SN-671603) Avail: NTIS HC/MF A03 CSCL 06K

A method and apparatus are disclosed for maintaining continuous, long-term microbial control in the water supply for potable, hygiene, and experimental water for space activities, as well as treatment of water supplies on Earth. The water purification is accomplished by introduction of molecular iodine into the water supply to impart a desired iodine residual. The water is passed through an iodinated anion exchange resin bed. The iodine is bound as I(sub n) at the anion exchange sites and releases I(sub 2) into the water stream flowing through the bed. The concentration of I(sub 2) in the flowing water gradually decreases and, in the prior art, the ion-exchange bed has had to be replaced. In a preferred embodiment, a bed of iodine crystals is provided with connections for flowing water therethrough to produce a concentrated (substantially saturated) aqueous iodine solution which is passed through the iodinated resin bed to recharge the bed with bound iodine. The bed of iodine crystals is connected in parallel with the iodinated resin bed and is activated periodically (e.g., by timer, by measured flow of water, or by iodine residual level) to recharge the bed. Novelty resides in the capability of inexpensively and repeatedly regenerating the ion-exchange bed in situ. NASA

N91-25581*# Eastern Virginia Medical School., Norfolk. Dept. of Pathology.

JELLYFISH: SPECIAL TOOLS FOR BIOLOGICAL RESEARCH ON EARTH AND IN SPACE

DOROTHY B. SPANGENBERG *In* NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 272-273 May 1991
Avail: NTIS HC/MF A18 CSCL 06E

The most intriguing nature of the jellyfish polyps is their ability to metamorphose, giving rise to tiny immature medusae called ephyrae which have a different form or shape from the polyps. The Aurelia Metamorphosis Test System was used to determine the subtle effects of hydrocarbons found in oil spills and the effects of X-irradiation on developing ephyrae. Currently, this test system is used to determine the effects of the gravity-less environment of outer space on the development and behavior of ephyrae. For this purpose, the effects of clinostat rotation on development of the ephyrae and their gravity receptor are being studied. The behavior of the ephyrae during 0 gravity achieved for short intervals of 30 seconds in parabolic flight is examined. The developing ephyrae and the mature ephyrae are exposed to gravity-less environment of outer space via a six or seven day shuttle experiment. If gravity receptors do form in outer space, they will be studied in detail using various types of microscopes, including the electron microscope, to determine whether they developed normally in space as compared with control on Earth. B.G.

N91-25582*# Eastern Virginia Medical School., Norfolk. Dept. of Pathology.

EFFECTS OF CLINOSTAT ROTATION ON AURELIA STATOLITH SYNTHESIS

DOROTHY B. SPANGENBERG, S. DAVIS, and H. ROSS-CLUNIS, III *In* NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 274-275 May 1991
(Contract NAG2-243)
Avail: NTIS HC/MF A18 CSCL 06C

Aurelia ephyrae develop eight graviceptors (rhopalia) during their metamorphosis from polyps, which are used for positional orientation with respect to gravity. In three experiments for each speed of 1/15, 1/8, 1/2, 1, and 24 rpm, groups of six polyps

were rotated in the horizontal or vertical plane (control) using clinostats. Other controls were kept stationary in the two planes. Ten ephyrae from each group were collected after 5 to 6 days at 27 C in iodine and the number of statoliths per rhopalium were counted. Statistical analyses of statolith numbers revealed that horizontal clinostat rotation at 1/4 and 1/2 rpm caused the formation of significantly fewer statoliths per rhopalium than were found in controls. The finding that these slow rates of rotation reduces statolith numbers suggests that the developing ephyrae were disoriented with respect to gravity at these speeds, causing fewer statocytes to differentiate or to mineralize. Author

N91-26669* Lockheed Engineering and Sciences Co., Washington, DC.

USSR SPACE LIFE SCIENCES DIGEST, ISSUE 29

LYDIA RAZRAN STONE, ed., RONALD TEETER, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, DC.) Washington NASA Mar. 1991 156 p
(Contract NASW-4292)
(NASA-CR-3922(34); NAS 1.26:3922(34)) Avail: NTIS HC/MF A08 CSCL 06E

This is the twenty-ninth issue of NASA's Space Life Sciences Digest. It is a double issue covering two issues of the Soviet Space Biology and Aerospace Medicine Journal. Issue 29 contains abstracts of 60 journal papers or book chapters published in Russian and of three Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. A review of a book on environmental hygiene and a list of papers presented at a Soviet conference on space biology and medicine are also included. The materials in this issue were identified as relevant to 28 areas of space biology and medicine. The areas are: adaptation, aviation medicine, biological rhythms, body fluids, botany, cardiovascular and respiratory systems, developmental biology, digestive system, endocrinology, equipment and instrumentation, genetics, habitability and environment effects, hematology, human performance, immunology, life support systems, mathematical modeling, metabolism, musculoskeletal system, neurophysiology, nutrition, personnel selection, psychology, radiobiology, reproductive system, space biology and medicine, and the economics of space flight. Author

N91-26670* Lockheed Engineering and Sciences Co., Washington, DC.

USSR SPACE LIFE SCIENCES DIGEST, ISSUE 30

LYDIA RAZRAN STONE, ed., RONALD TEETER, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, DC.) Washington NASA May 1991 112 p
(Contract NASW-4292)
(NASA-CR-3922(36); NAS 1.26:3922(36)) Avail: NTIS HC/MF A06 CSCL 06E

This is the thirtieth issue of NASA's Space Life Sciences Digest. It contains abstracts of 47 journal papers or book chapters published in Russian and of three Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. The abstracts in this issue have been identified as relevant to 20 areas of space biology and medicine. These areas include: adaptation, biospheric research, cardiovascular and respiratory systems, endocrinology, equipment and instrumentation, gastrointestinal system, group dynamics, habitability and environmental effects, hematology, human performance, immunology, life support systems, mathematical modeling, metabolism, musculoskeletal system, neurophysiology, nutrition, psychology, radiobiology, and space biology and medicine. Author

N91-26671# Army Biomedical Research and Development Lab., Fort Detrick, MD.

US ARMY BIOMEDICAL RESEARCH AND DEVELOPMENT LABORATORY Annual Progress Report, 1 Oct. 1989 - 30 Sep. 1990

STEPHEN C. HEMBREE 1 Jan. 1991 270 p
(Contract DA PROJ. 4E1-61102-BS-04; DA PROJ.

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3M1-61102-BS-15)

(AD-A233664) Avail: NTIS HC/MF A12 CSCL 15/6

The Annual Progress Report, Fiscal Year 1990, summarizes the research performed by the U.S. Army Biomedical Research and Development Laboratory in projects authorized by the U.S. Army Surgeon General and the Commander, U.S. Army Medical Research and Development Command. This research was supported by RDTE funds from the U.S. Army corps of Engineers, and from several additional sources. GRA

N91-26672# Nova Univ., Fort Lauderdale, FL.
PHYTOPLANKTON ABUNDANCE IN RELATION TO LAGRANGIAN PATHS Final Project Report, 1 Nov. 1988 - 31 Oct. 1990

GARY HITCHCOCK 1990 3 p

(Contract N00014-87-K-0040)

(AD-A233728) Avail: NTIS HC/MF A01 CSCL 08/1

The main objective of this effort was to examine the near-surface distribution of phytoplankton pigment, specifically chlorophyll a, in Gulf Stream meanders. This was accomplished by surveys of anticyclonic (crests) and cyclonic (troughs) meanders features during cruises in September, 1988 and April, 1989. This research program was part of the BioSYNOP Program, and our effort was conducted in conjunction with an NSF-sponsored physical oceanographic field effort supervised by Dr. Tom Rossby, University of Rhode Island. The hypothesis which was initially posed to the Office of Naval Research was that if our present understanding of the dynamics of meanders is correct, then upwelling of nutrient-rich, cool water along the leading edge of meander crests (that is, anticyclonic meanders), should result in enhanced standing stocks of phytoplankton biomass in these features. GRA

N91-26673# Naval Medical Research Inst., Bethesda, MD.
THE TRENDLENBURG POSITION AFTER CEREBRAL AIR EMBOLISM IN DOGS: EFFECTS ON THE SOMATOSENSORY EVOKED POTENTIAL, INTRACRANIAL PRESSURE, AND BLOOD-BRAIN BARRIER Technical Report, Sep. 1988 - Sep. 1989

ANDREW J. DUTKA, JOHN E. POLYCHRONIDIS, RICHARD B. MINK, and JOHN M. HALLENBECK Nov. 1990 41 p
(AD-A233809; NMRI-90-116) Avail: NTIS HC/MF A03 CSCL 06/5

Medical personnel routinely recommend placing the victim of dysbaric or nosocomial cerebral air embolism in the Trendelenburg position. This maneuver is expected to reduce the chance of subsequent cerebral air emboli and to hasten clearance of bubbles trapped in the cerebral circulation. The Trendelenburg position will also increase intracranial pressure and reduce cerebral perfusion pressure; this may have an adverse effect on recovery of the injured brain. We placed 8 dogs in the left lateral decubitus, 45 deg. Trendelenburg position for 1 h following cerebral air embolism and transient hypertension, then treated the animals with compression on a modified U.S. Navy Treatment Table 6A (head-down or HD group). We compared somatosensory evoked potentials (SSEP), intracranial pressure and pressure-volume index (PVI), brain water, and blood-brain barrier function assessed by extravasation of Evans Blue to these variables in nine embolized and hypertensive dogs maintained in a head-up (sphinx) position as controls (horizontal or HZ group). GRA

N91-26674# Naval Biodynamics Lab., New Orleans, LA.
A STATISTICAL ANALYSIS OF -X RHESUS HEAD KINEMATICS Research Report, 1985 - 1987

SALVADORE J. GUCCIONE, JR. 1 Oct. 1990 113 p
(AD-A233977; NBDL-89R006) Avail: NTIS HC/MF A06 CSCL 06/5

The use of the rhesus as a human surrogate in studying head-neck injury due to impact acceleration depends of the similarity of human and rhesus head-neck kinematic and dynamic responses. This report addresses the question of -X rhesus head-neck kinematics. The dependence of the first major peaks of head linear and angular accelerations, velocities and displacements on sled acceleration parameters and initial head

position is statistically analyzed. The effects of anesthetic state, repeated exposures and out-of-plane response on these key kinematics outputs are assessed. Various graphical and statistical comparisons indicate that: (1) human and rhesus -X head kinematics are not only similar in shape but, more importantly, depend on the same sled and head initial position parameters; (2) anesthetic state has no significant statistical effect on rhesus kinematic output; and (3) the effects of repeated tests and out-of-plane response can be reasonably explained. These results justify a fullscale attempt to fit key human and rhesus kinematics and dynamic responses and develop appropriate scaling procedures. Recommendations concerning the structuring of future human and rhesus experiments to facilitate the necessary statistical comparisons are also given. GRA

N91-26675# California Univ., Los Angeles. Mental Retardation Research Center.

INTRACELLULAR PHYSIOLOGY OF THE RAT SUPRACHIASMATIC NUCLEUS: ELECTRICAL PROPERTIES, NEUROTRANSMISSION, AND EFFECTS OF NEUROMODULATORS Annual Report, 1 Nov. 1989 - 31 Oct. 1990

F. E. DUDEK 28 Mar. 1991 7 p

(Contract AF-AFOSR-0056-90; AF PROJ. 2312)

(AD-A234442; AFOSR-91-0376TR) Avail: NTIS HC/MF A02 CSCL 06/5

The primary goal of this research has been to determine the electrophysiological properties of neurons in the suprachiasmatic nucleus (SCN), with particular emphasis on the mechanisms underlying synaptic transmission and neuromodulation. We have focused on the role of excitatory amino acids (i.e., glutamate) in synaptic transmission from the retina to the SCN. Our recent data indicate that non-NMDA receptors mediate transmission at low levels of activity, but NMDA receptors are likely important when the cells are depolarized. Our studies of synaptic inhibition in the SCN indicate that gamma amino-butyric acid (GABA) mediates fast inhibitory postsynaptic potentials. Ongoing experiments are aimed at examining the role of glutamate and GABA in expression of the circadian rhythm of electrical activity in the SCN. Finally, a series of experiments partially supported by this grant has been undertaken in the paraventricular nucleus and preoptic area of the hypothalamus. GRA

N91-26676# Utah Univ., Salt Lake City. Dept. of Chemistry.
IMAGING OF FLUORESCENT AND CHEMILUMINESCENT DNA HYBRIDS USING A 2-D CCD CAMERA Technical Report, Jun. 1990 - May 1991

A. KARGER, J. T. IVES, R. B. WEISS, J. M. HARRIS, and R. F. GESTELAND 22 Apr. 1991 14 p

(Contract N00014-89-J-1412)

(AD-A234641; TR-26-ONR) Avail: NTIS HC/MF A03 CSCL 06/1

Fluorescent and chemiluminescent detection of DNA hybrids on polymer membranes has been investigated using a cryogenically cooled, slow readout, two dimensional CCD camera in an imaging mode. The fluorescent background characteristics of commercially available nylon blotting membranes and a polypropylene membrane modified to bind DNA have been studied. The polypropylene membrane exhibits a 15-fold increase in DNA binding, 3-fold less background fluorescence and less background noise than nylon blotting membranes. However the detection limits determined from vacuum slot blots of crosslinked fluorescein-labelled oligonucleotides show that the improved qualities of the polypropylene support do not result in a lower detection limit. This is mainly due to background noise arising from sources other than the membrane itself during the blotting/washing procedure and to a low signal-to-amount of DNA ratio with the polypropylene membrane. The lowest amount of fluorescein-labelled oligonucleotide detectable is 1.4 femtomol, with a typical exposure time of 10 minutes to image a 6x9 cm area of the membrane. The detection of chemiluminescence was done using a biotin-avidin complex in combination with an enzymatic assay. GRA

N91-26677# Texas Univ., San Antonio. Health Science Center. **INTERACTION OF IONIZING RADIATION, GENETICALLY ACTIVE CHEMICALS, AND RADIOFREQUENCY RADIATION IN HUMAN AND RODENT CELLS** Final Report, 1 Oct. 1987 - 30 Sep. 1989

MARTIN L. MELTZ, PATRICIA K. HOLAHAN, STEVEN T. SMITH, JAMES J. KERBACHER, and VICTOR CIARAVINO Dec. 1990 79 p

(Contract F33615-87-C-0610)

(AD-A234747; USAFSAM-TR-90-18) Avail: NTIS HC/MF A05 CSCL 06/5

The purpose of this project was to investigate the possible interaction between radiofrequency radiation (RFR) and agents which are known to damage DNA. Experiments were performed using exposures of CHO cells to 350, 850, 1200, and 2450 MHz RFR at up to 40 W/kg and temperatures ranging from 37 to 40 C. No genotoxic effect was observed by sister chromatid exchange induction, chromosome aberration induction, or gene mutation (at the thymidine kinase locus). At levels at or below 10 mW/sq cm and specific absorption rates (SARs) at or below 4 W/kg, there was no evidence that DNA repair was induced or repair of preexisting DNA damage was inhibited. Adriamycin but not mitomycin C caused a statistically significant increase in the frequency of aberrant cells at 40 C with or without RFR. These observations support thermal mechanisms of RFR interaction.

GRA

N91-26678# General Electric Co., Schenectady, NY. Biological Sciences Div.

BIOLOGICAL SYNTHESIS OF SUBSTITUTED

O-AMINOPHENOLS Final Report, 1 Nov. 1987 - 13 Dec. 1990

TERRY K. LEIB Feb. 1991 86 p

(Contract F49620-88-C-0016)

(AD-A234910; REPT-91SRD001; AFOSR-91-0236TR) Avail: NTIS HC/MF A05 CSCL 06/5

Polybenzoxazoles are thermally stable, high modulus polymers made by the condensation of carboxylic acids with o-aminophenols. This report summarizes research to develop methods for the biosynthesis of substituted o-aminophenols from less expensive precursors such as substituted anilines, benzidine, and o-nitrophenols. One approach has been to exploit isolated enzymes to catalyze the desired reactions. Of the four enzymes we have studied for this purpose, tyrosinase shows the most promise. This enzyme has the desired catalytic activity, catalyzing the ortho hydroxylation of several anilines and benzidines, but the reaction rate is 100-fold slower than with phenols and an exogenous reductant must be added to the reaction to inhibit the enzyme-catalyzed oxidation of the desired o-aminophenol. As an alternative to this approach, we investigated the biosynthesis of o-aminophenols via bacterial reduction of o-nitrophenols. Bacterial strain P11, a GE isolate, catalyzes the reduction of nitroaromatic compounds. This bacterium, identified as a Group D Streptococci, has broad substrate specificity for this nitro-reductase activity and good viability under high product and substrate concentrations.

GRA

N91-26679# Ames Lab., IA.

ELECTRONIC EXCITATION TRANSPORT IN PHOTOSYNTHESIS AND CRYSTAL AND MOLECULAR STRUCTURES OF PORPHYRIN COMPOUNDS Ph.D. Thesis

SHUMEI YANG 22 Apr. 1991 276 p

(Contract W-7405-ENG-82)

(DE91-012024; IS-T-1513) Avail: NTIS HC/MF A13

The excitation energy transfer in three photosynthetic organism samples, Bacteriochlorophyll a-protein from *Prosthecochloris aestuarii*, and enriched photosystem 1 particles from spinach chloroplasts, have been investigated by pump-probe ultrafast spectroscopy. The isotropic photobleaching profiles were best described by two exponential decay components in one Bchl a-protein complex, and three exponential decay components in another. The experimental results from the three samples show that nonrandom chromophore orientations exist and Sauer's pebble mosaic model is an appropriate one for excitation transfer in these

samples. The polarized pump-probe transients have been analyzed in terms of an exciton hopping model that incorporates the known geometry of the Bchl a-protein. The crystal and molecular structures of four metalloporphyrins have been determined by x ray diffraction and molecular mechanics. DOE

N91-26680# Oak Ridge National Lab., TN.

INTRODUCTION TO SESSION 2: APPLIED BIOLOGICAL RESEARCH

G. W. STRANDBERG and A. L. DEMAINE (Massachusetts Inst. of Tech., Cambridge.) 1991 2 p Presented at the 13th Symposium on Biotechnology for Fuels and Chemicals, Colorado Springs, 6-10 May 1991

(Contract DE-AC05-84OR-21400)

(DE91-012067; CONF-910550-1-EXTD-ABST) Avail: NTIS HC/MF A01

The papers in this session continue in the tradition of presenting excellent research directed at the development of new and enhanced biological process through applied biological research. The majority of the research discussed entails the use of newer, molecular biological approaches which have added significantly to our abilities to understand and control microbial activities. DOE

N91-26681# California Univ., Berkeley. Lawrence Berkeley Lab.

FLUORESCENCE SPECTROSCOPY OF EXCITATION TRANSFER IN PHOTOSYSTEM 1 Ph.D. Thesis

I. MUKERJI Dec. 1990 140 p

(Contract DE-AC03-76SF-00098)

(DE91-011867; LBL-30136) Avail: NTIS HC/MF A07

A study is presented of excitation transfer in a photosynthetic antenna array. The spectroscopic properties of two pigment-protein complexes were investigated. These complexes, isolated from higher plants, display an unusual temperature dependent fluorescence behavior. This fluorescence behavior was studied with respect to energy transfer to the reaction center and in an isolated intact antenna preparation. A Photosystem 1 complex, PSI-200, was isolated from spinach. This system was characterized by both steady state and time resolved fluorescence spectroscopy. Fluorescence polarization measurements indicate that this emission arises from pigments which absorb in the long wavelength region of the spectrum and comprise a relatively small portion of the antenna population. Comparison of spectral characteristics were made with a PSI complex isolated from the thermophilic cyanobacterium, *Synechococcus*, sp. To address the role of Chl b in stimulating long wavelength fluorescence and the temperature dependence of the system, the energy transfer dynamics were studied in an antenna complex, LHC-I isolated from PSI-200. Kinetic measurements indicate that initially absorbed excitation is rapidly redistributed to longer wavelength emitting pigments within 40 ps. The temperature dependence of F685 results from increased back transfer from long wavelength emitters to F685. It is suggested that changes in excitation transfer between the various emitting species and a non-radiative fluorescence quenching mechanism account for the temperature dependence of the system. DOE

N91-26682# Arizona Univ., Tucson. Dept. of Biochemistry.

PHOTOCHEMICAL ENERGY CONVERSION BY MEMBRANE-BOUND PHOTOREDOX SYSTEMS

G. TOLLIN 1991 5 p

(Contract DE-FG02-86ER-13631)

(DE91-012171; DOE/ER-13631/T1) Avail: NTIS HC/MF A01

We have developed a system for carrying out chlorophyll (chl)-photosensitized vectorial transbilayer electron transfer from reduced cytochrome c (cyt) in the inner aqueous compartment of negatively charged unilamellar lipid bilayer vesicles to oxidized ferridoxin (fd) in the outer aqueous phase, with the viologen analog propylene diquat in the outer phase as a mediator. This was investigated using both laser flash and steady state photolysis techniques. The results demonstrate that triplet chl is initially quenched by viologen at the outer membrane surface to form chl cation radical and viologen radical, followed by a biphasic recombination. The slow phase represents reverse electron transfer

and could be suppressed by reduction of the chl radical by reduced cyt at the inner vesicle surface, following transbilayer electron transfer, and by electron transfer from viologen radical to oxidized fd. These reactions lead to charge separation across the vesicular membrane. The yields are limited by the formation of the transmembrane potential and accumulation of oxidized cyt in the lumen of the vesicle. Addition of the ionophore valinomycin will diminish the membrane potential, and double the reaction yield. It is important to note that this system mimics one of the key events in photosynthesis (Photosystem 1) and results in appreciable energy storage in the reaction products (about 0.7 V). Reduction of cyt has been investigated at a Pt electrode modified with a lipid bilayer membrane with immobilized vinyl ferrocene as a mediator. The current-voltage curves show that the direct reduction of cyt at the electrode occurs quite efficiently, allowing us to calculate an absorption equilibrium constant and an electron transfer rate constant. These results suggest that biomembrane-like electrode surfaces have potential for metalloprotein electrochemistry, as well as the development of biosensors.

DOE

N91-26703# Joint Publications Research Service, Arlington, VA.
EFFECTS OF 13 DAY SPACE FLIGHT ON SKELETAL MUSCLES AND NEUROMUSCULAR JUNCTIONS IN RATS

Abstract Only

O. M. POZDNYAKOV, L. L. BABAKOVA, M. S. DEMORZHI, and YE. I. ILYINA-KAKUYEVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 38-42

Avail: NTIS HC/MF A03

Ultrastructural studies were performed on the soleus, gastrocnemius, and diaphragmatic muscles of 334 g Wistar rats to assess the effect on a 13 day space flight aboard a Cosmos biosatellite. The study was designed to assess changes occurring in skeletal muscles differing in normal physiological requirements for contraction. Accordingly, minimal adverse changes of a readily reversible nature were evident in the diaphragm. The atrophic changes were more pronounced in the gastrocnemius muscles than in the soleus, again confirming the fact that baseline activity was a key factor in tolerating the adverse effects of weightlessness. Assessment of neuromuscular junctions paralleled the results obtained with the muscles. Fragmentation of the junctions was most pronounced in the gastrocnemius and was compounded by macrophage invasion. Author

N91-26704# Joint Publications Research Service, Arlington, VA.
EFFECT OF 7 DAY ANTIORTHOSTATIC HYPOKINESIA ON CARDIAC PUMPING ACTION IN MONKEYS Abstract Only

G. T. KAZAKOV and V. P. KROTOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2-3 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 56-57

Avail: NTIS HC/MF A03

The effects of a 7 day antiorthostatic, hypokinetic regimen on the pumping and contractile activity of the left ventricle were studied in three rhesus monkeys, weighing 4.9 kg. The results showed that a -20 degree inclination resulted in a significant decrease in the end diastolic volume (12 percent), as well as a reduction in the stroke index (7 percent), end systolic volume (6 percent), ejection fraction (4 percent) and delta S (7 percent). The heart rate and cardiac index were increased by 15 and 11 percent, respectively. The changes became even more pronounced after seven days when the animals were returned to the horizontal position, with the exception of the ejection fraction and delta S which remained unaltered. Consequently, the sequelae of seven days of antiorthostatic hypokinesia consisted of diminished venous return and only moderate abatement of left ventricular contractility. Author

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A91-40573#

RELATIONSHIP BETWEEN THE CHANGE OF CIRCULATING LYMPHOCYTE NUMBER AND PLASMA CORTISOL CONCENTRATION AFTER AN EASTWARD TRANSMERIDIAN FLIGHT

HIROFUMI OHKOSHI, ICHIRO ASUKATA, YUMIKO FUJITA, MIKIO UEMATSU, NAOKO TAJIMA (Japan Airlines, Flight Crew Medical Service Dept., Tokyo) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 28, March 1991, p. 11-17. In Japanese, with abstract in English. refs

The relationship between the modified lymphocyte count and the concentration of plasma cortisol is examined after a transmeridian flight to facilitate understanding of the postflight increase in circulating T-lymphocytes. The lymphocytes of six male volunteers are studied before and after an eastward flight corresponding to 16 hours of time difference. Before the flight, plasma cortisol concentration is shown to be inversely proportional to the OKT4+ lymphocyte count. Counts of other lymphocyte types are not demonstrated to vary as the plasma cortisol concentration is changed. Postflight data do not indicate a correlation between the OKT4+ lymphocyte count and plasma cortisol concentration. The independence of the postflight OKT4+ lymphocyte count from the plasma cortisol concentration suggests that another factor accounts for the lymphocyte modification associated with transmeridian flights. C.C.S.

A91-40574#

EFFECTS OF SHORT-TERM TRAVEL ABROAD ON CIRCADIAN RHYTHM OF SALIVARY CORTISOL LEVEL

SHIMU FUJIBAYASHI (Showa University, Tokyo, Japan) and MASAMICHI SUDOH (Jikei University School of Medicine, Tokyo, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 28, March 1991, p. 19-22. refs

Salivary cortisol concentrations are examined to determine the effectiveness of their use in evaluating adrenocortical function during transmeridian flight studies. Cortisol concentration levels are reported for measurements taken from one male subject before, during, and after a 7-hour transmeridian flight. The disruption of adrenocorticotropin-cortisol periodicity is associated with the desynchronization of bodily rhythms, an effect which is theorized to disorder the circadian rhythm of cortisol. Irregular and stressful in-flight conditions are related to the increase in salivary cortisol concentrations. The results of monitoring the circadian rhythm in salivary cortisol levels in this context suggests that field studies of transmeridian flights can be conducted in this way. C.C.S.

A91-41142

PEDALLING IN SPACE AS A COUNTERMEASURE TO MICROGRAVITY DECONDITIONING

G. ANTONUTTO, C. CAPELLI, and P. E. DI PRAMPERO (Udine, Universita, Italy) Microgravity Quarterly (ISSN 0958-5036), vol. 1, no. 2, 1991, p. 93-101. refs

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A two-bicycle system for exercising during spaceflight in order to prevent deconditioning due to microgravity is proposed, in which two mechanically coupled counterrotating bicycles are moved on the inner wall of a cylindrical space module. The two pedaling subjects generate a centrifugal acceleration vector, a(c), simulating gravity, which depends on the peripheral velocity and on the radius of gyration. It is shown that, by selecting appropriate radial dimensions of the space module, it is possible to minimize vestibular disturbances and head-to-feet centrifugal acceleration gradients, and, thus, combine the exercise and simulate microgravity with no need for additional external power. I.S.

A91-43235

PANEL ON DELIBERATE G-INDUCED LOSS OF CONSCIOUSNESS - INTRODUCTION

RUSSELL R. BURTON (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 609-611. refs
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G-induced loss of consciousness (G-LOC) is discussed in terms of its relevance to aviation, the need to study its effects, and the problems associated with such experimental investigation. Because G-LOC has been identified as an important operational problem which creates hazardous flight situations, studies are being developed which require G-LOC during the course of the investigation. Animal models have been and are being used for the study of G-LOC and are found to introduce certain experimental limitations. Physiological and legal concerns are outlined regarding the use of human subjects in G-LOC research, emphasizing the need for uniform investigatory guidelines. The present conference on G-LOC is identified as a practical forum for reviewing the use of animal models in the study of the phenomenon, and the implications of employing human subjects. C.C.S.

A91-43236

PHYSIOLOGIC BASES OF G-INDUCED LOSS OF CONSCIOUSNESS (G-LOC)

PAUL M. WERCHAN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 612-614. refs
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Exposure of pilots to high sustained +Gz (head to feet) or rapid onset of +Gz can produce a variety of pathophysiologic effects ranging from the loss of peripheral vision to total blackout and, finally, G-induced loss of consciousness (G-LOC). A G-LOC research program divided into four phases has been organized at USAFSAM/Crew Technology Division. In contrast to previous studies in acceleration, this program will focus exclusively on the ultimate problem in G-LOC; namely, inadequate cerebral perfusion leading to impaired brain energy metabolism, structure, and function. The primary objective of this research program is to identify and arrange chronologically the numerous physiological and biochemical alterations in the brain that comprise the mechanism of G-LOC. Author

A91-43238

MEDICAL CONSIDERATIONS FOR HUMAN EXPOSURE TO ACCELERATION-INDUCED LOSS OF CONSCIOUSNESS

JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 618-623. refs
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Medical problems related to the study of G-induced loss of consciousness (G-LOC) are discussed with respect to the use of human subjects to determine the benefits of such study. The benefits of G-LOC research with human subjects are set forth with particular attention given to the resolution of the G-LOC problem in aviators. The limitations associated with animal-subject study and modeling techniques are reviewed. The risks of studying G-LOC in humans are related to the central nervous, cardiac, and musculoskeletal systems, and a central nervous system insult classification system is proposed for the uniform observation of risk. This classification scheme can aid in the evaluation of potential adverse G-LOC effects by emphasizing acute and chronic monitoring and evaluation methods. G-LOC study on human subjects is characterized as important for understanding the acute and long-term effects of the phenomenon and its implications in aviation. C.C.S.

A91-43239

A REVIEW OF CENTRAL NERVOUS SYSTEM EFFECTS OF G-INDUCED LOSS OF CONSCIOUSNESS ON VOLUNTEER SUBJECTS

DAVID R. JONES (Aeropsych Associates, San Antonio, TX)

Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 624-627. refs
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The central nervous system (CNS) effects of G-induced loss of consciousness (G-LOC) in human subjects are reviewed with respect to studies involving human volunteer subjects. Historical literature is reviewed and found to report a very small number of adverse CNS effects. The lack of reported effects is explained by the unavailability of neuropsychological testing and noninvasive CNS imaging as well as the lack of long term follow-up studies. The risk of organic and functional CNS damage from G-LOC studies is considered in relation to the potential risks of +Gz exposure in flight and of aircraft accidents caused by G-LOC. It is concluded that continued study of G-LOC with human subjects is necessary, and that it is important to notify the subjects of the risks associated with such study and to use head restraints to protect the subjects from postural trauma and impact injury. C.C.S.

A91-43240

LEGAL AND ETHICAL ASPECTS OF DELIBERATE G-INDUCED LOSS OF CONSCIOUSNESS EXPERIMENTS

JOSEPH G. EURETIG (USAF, Air Logistic Center, McClellan AFB, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 628-631. refs
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Informed consent is both a legal and accepted ethical prerequisite to nontherapeutic human experimentation. The informed consent obtained from the subject in G-LOC experimentation is in the same form as the risk disclosures used in high-G acceleration experiments. However, in high acceleration protocols G-LOC is a potential risk while in G-LOC experiments it is the result. The case law embodies three modern evidentiary standards (the 'professional', 'material fact', and 'possible risks' tests) employed by common law courts when deciding whether the risk disclosures are sufficient to elicit the informed consent of the subject. Each standard is applied against the disclosures in the G-LOC protocol to determine if the elements of the requirement are met. The risk disclosures are wanting in specific identification of possible risks in human G-LOC experiments when examined under the three tests. The deficiency is the failure to inform the subject that G-LOC may result in a pathologic state of unconsciousness about which little is known. Without complete disclosure of this lacking state of medical knowledge, it is questionable whether informed consent can be given. If subjected to judicial scrutiny, the disclosures stated in the G-LOC protocol used in government sponsored research will probably be found deficient. Author

A91-43241

MAPPING OF EVOKED MAGNETIC FIELD WITH VISUAL STIMULATION - A SECONDARY PROJECTION AND PROCESSING AREA

AKIRA MIAMOTO (Nihon University, Tokyo, Japan) and GLENN F. WILSON (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 638-647. refs
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Visual evoked fields (VEFs) were measured in four subjects, using magnetoencephalography and a flashed checkerboard-pattern stimulation with a duration of 20 ms. The left hemisphere was searched for the primary and the secondary projection areas with a full-field stimulus. Typical VEFs were found in the occipital area which is considered to be the primary projection, and a secondary projection area was found in the dorsal temporal area in all subjects. The negative VEF in the secondary projection area was robust and stable, with a range of latencies from 200 to 230 ms. The amplitude was more than -400 femtotesla, as high as the VEF in the occipital area. However, the position of a dipole was not located because only one amplitude maxima was found. Author

A91-43242**EFFECTS OF ACUTE ASPARTAME AND ACUTE ALCOHOL INGESTION UPON THE COGNITIVE PERFORMANCE OF PILOTS**

ALAN F. STOKES, HENRY TAYLOR (Illinois, University, Savoy), AYSEIL BELGER, and MARIE T. BANICH (Illinois, University, Champaign) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 648-653. refs
(Contract DTFA02-87-C-87068)
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Anecdotal evidence has associated the artificial sweetener aspartame with a number of symptoms of central nervous system dysfunction. Thirteen pilots were tested in a double-blind study using the Spartans cognitive test battery of aviation-relevant information-processing tasks. These tasks relate to perceptual-motor abilities, spatial abilities, working memory, attentional performance, risk taking, processing flexibility, planning and sequencing ability. The treatment conditions involved an aspartame dose of 50 mg/kg body weight, a placebo condition, and an ethyl alcohol condition as the positive control. No detectable performance decrements were associated with the aspartame condition, although decrements in psychomotor and spatial abilities were detected in the ethanol condition. Results were found to be consistent with prior flight-simulator studies of alcohol, but do not appear to support the concerns expressed in anecdotal testimony regarding the deleterious effects of aspartame upon cognitive performance. Author

A91-43243**EFFECTS OF TEMAZEPAM ON SLEEP, PERFORMANCE, AND RHYTHMIC 6-SULPHATOXYMELATONIN AND CORTISOL EXCRETION AFTER TRANSMERIDIAN TRAVEL**

ERIC DONALDSON (Royal Australian Army Medical Corps, Oakey, Australia) and DAVID J. KENNAWAY (Adelaide, University, Australia) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 654-660. Wyeth Pharmaceutical Pty., Ltd.-sponsored research. refs
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Temazepam was administered to 10 human subjects during and after a flight through 11 time zones to study the consequences of the benzodiazepine on sleep, performance, and pineal, adrenal, and temperature rhythms. Urine samples, temperature measurements, performance tests, and questionnaires are used to assess temazepam's effects. Sleep characteristics improve notably on the first few nights following the flight, and performance is not affected by the treatment. Peak 6-sulphatoxymelatonin excretion occurred later in the day after legs of the flight although temazepam had no effect on the rate of change. Temazepam did not affect the adjustment of urinary cortisol and temperature rhythms. It is concluded that a significant beneficial effect accompanies the administration of temazepam in terms of sleep and alertness after transmeridian flights without affecting physiological rhythms. C.C.S.

A91-43244**SLEEP PATTERNS IN AIRCREW OPERATING ON THE POLAR ROUTE BETWEEN GERMANY AND EAST ASIA**

ALEXANDER SAMEL, HANS M. WEGMANN, WOLFGANG SUMMA (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), and MARTIN NAUMANN (Deutsche Lufthansa AG, Cologne, Federal Republic of Germany) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 661-669. Bundesministerium fuer Verkehr-supported research. refs
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Circadian rhythmicity and sleep behavior are monitored on the aircrew operating six different regular polar route flights. Sleep and subjective sleep characteristics are documented for 101 crewmembers for at least three days before and four days after the flights. The two flight legs include Germany-Anchorage and Anchorage-East Asia, and both outgoing and return flights are considered. The first flight to Anchorage (ANC) and the East Asia-ANC return flight cause the greatest sleep deficits owing to

time difference and brief layovers, while the deficit is reduced during the long layover in East Asia. Increased napping during the long layovers and the first two days after returning home correspond to poor sleep quality, although the sleep decrements are found to be serious in only two of the six duty rosters. For some flight schedules it is concluded that the sleep deficits can affect the operational aspects of the flights. C.C.S.

A91-43246**PREDICTION OF THE EXERCISE-HEAT TOLERANCE OF SOLDIERS WEARING PROTECTIVE OVERGARMENTS**

LAWRENCE E. ARMSTRONG, PATRICIA C. SZLYK, INGRID V. SILS, JANE P. DE LUCA, CATHERINE O'BRIEN (U.S. Army, Army Research Institute of Environmental Medicine, Natick, MA; Connecticut, University, Storrs) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 673-677. refs
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The purpose of this investigation was to see whether subject characteristics and physiologic measurements predicted exercise-heat tolerance (EHT) and voluntary tolerance time. Unacclimatized males attempted six 50-min periods while wearing protective overgarments. Two post hoc groups of soldiers were defined: high EHT (H) and low EHT (L). Significant H vs. L differences were observed in pretrial body mass, percent fat, and mass-to-surface-area ratio, as well as 170 min heart rate, mean weighted skin temperature Tsk and heat storage. The first three of these factors indicated that preexercise anthropomorphic characteristics distinguish H from L. The heart rate and Tsk differences mean that L experienced greater cardiovascular strain because of a higher Tsk, which resulted in increased pooling of blood in cutaneous vessels, decreased cardiac filling pressure, and increased fatigue. Because heart rate variables were the strongest correlates of exercise-tolerance time a novel heart beat monitoring technique was proposed which uses a wrist-mounted cardi tachometer to predict tolerance time. Author

A91-43247* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

INFLUENCE OF ECCENTRIC ACTIONS ON THE METABOLIC COST OF RESISTANCE EXERCISE

GARY A. DUDLEY, CATHERINE L. GOLDEN (NASA, Kennedy Space Center; Bionetics Corp., Cocoa Beach, FL), PER A. TESCH (Karolinska Institutet, Stockholm, Sweden), ROBERT T. HARRIS (Ohio University, Athens), and PAUL BUCHANAN (NASA, Kennedy Space Center, Cocoa Beach, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 678-682. refs
(Contract NAS10-10285; NAS10-11624)
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The contributions of concentric (con) and eccentric (ecc) muscle actions are evaluated with respect to increasing the metabolic cost of resistance exercise. Male subjects perform leg exercise with either con and ecc actions or only con actions while the net energy cost of the exercise is measured by oxygen consumption data. In both groups, the con actions require 290 J/kg body weight of total work, with an energy cost of 0.003 cal/J. The energy costs for the con/ecc actions of the second group is increased by 14 percent. The metabolic cost of leg exercise is concluded to be primarily generated by the con leg actions, and ecc leg actions increase the resistance with only a slight increase in required energy. The findings are significant for practical applications that emphasize the conservation of energy expenditure during exercise in spacecraft environments. C.C.S.

A91-43248**TIME COURSE AND CLINICAL SIGNIFICANCE OF MARKED LEFT AXIS DEVIATION IN AIRLINE PILOTS**

T. TAMURA, C. KOMATSU, I. ASUKATA, K. YAMAMOTO, and M. HORARI (Japan Airlines, Flight Crew Medical Service Dept., Tokyo) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 683-686. refs
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The purpose of this study was to examine the time course and evaluate the clinical significance of marked left-axis deviation (LAD) in airline pilots. The study group consisted of 30 Japan Airlines pilots with marked LAD, identified from a group of 1,700 who are now 35 years of age or older. The prevalence rate of marked LAD was 1.8 percent. In 20 percent, the axis remained unchanged, and in 70 percent, LAD progressed either gradually or suddenly. All subjects were examined by exercise testing and 26 had echocardiograms. Two pilots were found to have organic heart disease (hypertension), which was much lower than the rate reported previously. In these individuals, the onset of marked LAD was noted more than 10 years before hypertension was detected. No progression to complete left bundle branch block, nor any form of AV blocks, was observed among these subjects. Author

A91-43249

THE EFFECT OF DELAY ON TREATMENT OUTCOME IN ALTITUDE-INDUCED DECOMPRESSION SICKNESS

FREDERICK W. RUDGE and MICHAELA R. SHAFER (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 687-690. refs

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Records were reviewed to determine whether a relationship exists between the length of time from development of symptoms of altitude chamber decompression sickness (DCS) to start of compression therapy and the outcome of treatment. Two-hundred and thirty-three cases of altitude chamber DCS were treated in USAF hyperbaric chambers. Information obtained from each record included age, sex, time from exposure to symptom onset, time from symptom onset to start of compression therapy, time required for resolution of symptoms, and number of treatment failures (failure to resolve during the first treatment dive or recurrence of symptoms after the first dive). A direct relationship between length of delay to treatment with compression therapy and outcome of treatment is observed. Patients successfully treated with a single treatment dive had an average delay to treatment of 10.6 h. Patients that failed treatment after one dive (failed to resolve or recurred) had an average delay to treatment of 18.2 h. The difference between these groups is significant. Author

A91-43250* Georgetown Univ., Washington, DC.

MICROGRAVITY TESTING A SURGICAL ISOLATION CONTAINMENT SYSTEM FOR SPACE STATION USE

SANFORD M. MARKHAM (Georgetown University, Washington, DC) and JOHN A. ROCK (Johns Hopkins Hospital, Baltimore, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 691-693. NASA-supported research. refs

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Anticipated hazards for crewmembers in future long term space flights may result in a variety of injuries including trauma and burns. Management of these injuries will require special techniques because of the lack of gravity, limitations of space and environmental restrictions. A small surgical isolation containment system was developed and tested in microgravity. The chamber provided both protection of the injury and of the cabin environment and is felt to be the most effective means of trauma and burn care in future Health Maintenance Facilities planned for prolonged space exposure. Author

A91-43689

DOUBLY LABELED WATER MEASUREMENT OF HUMAN ENERGY EXPENDITURE DURING STRENUOUS EXERCISE

R. W. HOYT, T. E. JONES, T. P. STEIN, G. W. MCANINCH, H. R. LIEBERMAN (U.S. Army, Research Institute of Environmental Medicine, Natick, MA; New Jersey, University of Medicine and Dentistry, Camden; U.S. Marine Corps, Mountain Warfare Training Center, Bridgeport, CA) et al. Journal of Applied Physiology (ISSN 8750-7587), vol. 71, July 1991, p. 16-22. refs

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The energy expenditures (EE) of 23 adult male Marines were measured during a strenuous 11-day cold-weather field exercise

at 2,200- to 2,550-m elevation by both doubly labeled water (DLW) and intake balance methods. Mean DLW EE did not differ significantly from intake balance EE estimated from food intake and either anthropometric or isotope dilution estimates of the change in body energy stores. The DLW method can be used with at least the same degree of confidence as the intake balance method to measure the EE of active free-living humans. Author

A91-43690

HEAT DEBT DURING COLD AIR EXPOSURE BEFORE AND AFTER COLD WATER IMMERSIONS

P. TIKUISIS, D. H. MCCracken, and M. W. RADOMSKI (Defence and Civil Institute of Environmental Medicine, North York; Toronto, University, Canada) Journal of Applied Physiology (ISSN 8750-7587), vol. 71, July 1991, p. 60-68. Defence and Civil Institute of Environmental Medicine-supported research. refs

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Three methods of calculation are presented for determining a heat debt. The first is based on a mean-weighted body temperature, while the other two are based on the integration of heat storage (S), where heat losses are measured in one and predicted in the other. Five healthy young males were exposed to 10 C air for 2 h on four different occasions. The latter two methods are considered to be more accurate for transient heat debt calculation. The cases of individual acclimation were different among the subjects, resulting in pooled responses that indicated no group acclimation by means of any of the three methods of calculation. It is demonstrated that under certain conditions actual changes in insulation and metabolism cannot be masked by changes in heat debt. It is recommended that the integration of S should be used to calculate heat debt for non-steady-state conditions, and heat debt should not be used as the only index of acclimation. O.G.

A91-43691

COLD EXPOSURE DURING MILITARY OPERATIONS - EFFECTS ON ANAEROBIC PERFORMANCE

A. C. HACKNEY, J. M. SHAW, J. A. HODGDON, J. T. COYNE, and D. L. KELLEHER (North Carolina, University, Chapel Hill; U.S. Navy, Naval Health Research Center, San Diego, CA) Journal of Applied Physiology (ISSN 8750-7587), vol. 71, July 1991, p. 125-130. U.S. Navy-supported research. refs

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The effects of military field operations (MFO) have been examined under different environmental conditions on anaerobic performance. U.S. Marines tested in noncold (NC, 10-32 C) and cold (CO, -2 to -22 C) environment performed 30 Wingate tests (WIN) pre-MFO and post-MFO immediately post-MFO to assess anaerobic performance. WIN measures obtained include absolute and relative mean power (MP), 5-s peak power (PP), and fatigue index (percent decline). Reductions occurred in absolute MP (651.8 + or - 30.3 to 616.4 + or - 28.5 SE W) and PP (897.8 + or - 41.6 to 857.0 + or - 39.1 W); no effect on fatigue index was seen. In relative measures, significant interaction effects were observed (P less than 0.05). The changes were found despite significant but comparable prepost weight reductions in both CO and NC conditions. It is concluded that WIN performance is reduced by participation in MFO, and cold exposure augments these responses when accounting for body weight changes. O.G.

A91-43692

ENHANCED EXERCISE-INDUCED RISE OF ALDOSTERONE AND VASOPRESSIN PRECEDING MOUNTAIN SICKNESS

PETER BAERTSCH, MARCO MAGGIORINI, WOLFGANG SCHOBERSBERGER, SIDNEY SHAW, WOLFGANG RASCHER (Bern, Universitaet; Medizinische Poliklinik Inselspital; Kinderspital, Basel; University Hospital, Zurich, Switzerland; Innsbruck, Universitaet, Austria; Essen, Universitaetskinderklinik, Federal Republic of Germany) et al. Journal of Applied Physiology (ISSN 8750-7587), vol. 71, July 1991, p. 136-143. SNSF-supported research. refs

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To investigate the hormonal responses to exercise, 18

mountaineers were subjected at low altitude and after a rapid ascent to high altitude (4,559m) to a 30 min exercise test on a bicycle ergometer at a work load comparable to the physical effects associated with mountaineering. The results are related to the occurrence of acute mountain sickness (AMS) during a subsequent stay of 3 days at high altitude. It is found that mean heart rates during exercise both at low (LA) and high (HA) altitudes and during active ascent to HA were similar. Exercise-induced changes at LA did not differ significantly between the eight subjects who stayed well and the nine subjects who developed AMS during a 3-day sojourn at HA. In the AMS group, exercise at HA caused a fall in mean blood pressure (-13 ± 2 vs. 0 ± 2 Torr, P less than 0.05) and a greater rise of norepinephrine (14.6 ± 1.6 vs. 8.9 ± 1.3 nmol/l, $P=0.01$), and adrenocorticotrophic hormone (30.9 ± 13.8 vs. 7.9 ± 2.8 pmol/l, $P=0.07$). O.G.

A91-43693**PHYSIOLOGICAL RESPONSES TO GLYCEROL INGESTION DURING EXERCISE**

ROBERT MURRAY, DENNIS E. EDDY, GREGORY L. PAUL, JOHN G. SEIFERT, and GEORGE A. HALABY (Quaker Oats Co., Exercise Physiology Laboratory, Barrington, IL) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 71, July 1991, p. 144-149. refs

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The effects of the consumption of glycerol during steady-state cycling exercise have been studied to determine if positive thermoregulatory, cardiovascular, and hormonal responses are associated with glycerol ingestion. Nine subjects cycled for 90 min at 50 percent peak O₂ uptake in a 30°C, 45 percent relative humidity environment. Beverages tested were a 10 percent glycerol solution (G), a 6 percent carbohydrate-electrolyte beverage (CE), the 6 percent carbohydrate-electrolyte plus 4 percent glycerol (CEG), and a water placebo (WP), ingested at regular intervals during the first 60 min of exercise. Experimental results show that ingestion of the glycerol solutions caused an increase in plasma osmolality and attenuation of the decrease in plasma volume associated with the WP treatment (P less than 0.05). Plasma renin activity was highest with WP (P less than 0.05), and G was associated with increased antidiuretic hormone levels (P less than 0.05). The data obtained indicate that there are no substantial metabolic, hormonal, cardiovascular, or thermoregulatory advantages to the consumption of solutions containing 4 or 10 percent glycerol during exercise. O.G.

A91-43695**DECREASED RELIANCE ON LACTATE DURING EXERCISE AFTER ACCLIMATIZATION TO 4,300 M**

G. A. BROOKS, G. E. BUTTERFIELD, R. R. WOLFE, B. M. GROVES, R. S. MAZZEO (California, University, Berkeley; USVA, Medical Center, Stanford University, Palo Alto; Texas, University, Galveston; Colorado, University, Denver; Colorado, University, Boulder; McMaster University, Hamilton, Canada) et al. *Journal of Applied Physiology* (ISSN 8750-7587), vol. 71, July 1991, p. 333-341. Research supported by Cigarette and Tobacco Surtax Fund of California, University of California, and Shaklee Corp. refs

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The hypothesis is presented that elevated blood lactate concentration during exercise under conditions of acute hypobaric hypoxia is associated with an increased lactate appearance rate (Ra). Subjects of the experiment were seven healthy men that were on a controlled diet in the postabsorptive condition at sea level, on acute exposure to 4,300 m, and after 3-week of acclimatization to 4,300 m. They received a primed-continuous infusion of glucose and lactate and rested for 90 min followed immediately by 45 min of exercise. During rest at sea level Ra was 0.52 ± 0.03 mg/kg min; this increased sixfold during exercise to 3.24 ± 0.19 mg/kg min. During exercise on acute exposure, Ra rose to 18.6 ± 2.9 mg/kg min. During rest and exercise mean lactate Ra and epinephrine values correlated ($r=0.43$ and 0.88 , respectively). It is concluded that

sympathetic-adrenergic responses are important in regulating the metabolic response to high altitude. Acclimatization results in decreased dependence on blood lactate as a means of disturbing carbohydrate potential energy. O.G.

A91-43997**IMPEDANCE CARDIOGRAPHY USING BAND AND REGIONAL ELECTRODES IN SUPINE, SITTING, AND DURING EXERCISE**

ROBERT P. PATTERSON, LI WANG, and SYED B. RAZA (Minnesota, University, Minneapolis) *IEEE Transactions on Biomedical Engineering* (ISSN 0018-9294), vol. 38, May 1991, p. 393-400. refs

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The electrical impedance and its first derivative (dZ/dt) were measured at 100 kHz on ten normal males in supine and sitting positions and during upright bicycle exercise in order to compare the contribution of regional electrodes to the standard band electrode signal and to evaluate the possible use of spot electrodes for stroke volume (SV) measurements. Simultaneous measurements were made from band electrodes placed around the neck and lower thorax and from spot electrodes which recorded signals from the neck, upper thorax, and lower thorax. The results showed that approximately equal parts of the dZ/dt waveform came from the neck and upper thorax with the lower thorax contribution small but providing important features of the band signal. Changing from supine to sitting showed percentage decreases of 35 percent and 46 percent for the band and neck signals, respectively, with an increase of 19 percent for the upper thorax signal. The percentage increases in SV with upright exercise were 34 percent, 52 percent, and 24 percent for the band, neck, and upper thorax signals, respectively. I.E.

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SPACELAB LIFE SCIENCES 1: REPRINTS OF BACKGROUND LIFE SCIENCES PUBLICATIONS

RONALD WHITE, ed. and JOEL I. LEONARD, ed. (Lockheed Engineering and Sciences Co., Washington, DC.) May 1991 412 p Prepared in cooperation with GE, Houston, TX (NASA-TM-104962; NAS 1.15:104962) Avail: NTIS HC/MF A18 CSCI 06E

The research being conducted on SLS-1 is primarily concerned with the short-term adaptation of physiological systems to weightlessness. A comprehensive overview of the various disciplines being studied on SLS-1 is presented. Citations and abstracts of all the papers submitted by the SLS-1 investigator teams are contained. The physiological systems studied include: cardiovascular and cardiopulmonary, musculoskeletal, neuro-vestibular, renal and endocrine, hematological, and immunological.

N91-25572*# California Univ., San Francisco. Dept. of Medicine.

THE ROLE OF CALCIUM IN OSTEOPOROSIS

C. D. ARNAUD and S. D. SANCHEZ /In NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 3-20 May 1991

Avail: NTIS HC/MF A18 CSCI 06E

Calcium requirements may vary throughout the lifespan. During the growth years and up to age 25 to 30, it is important to maximize dietary intake of calcium to maintain positive calcium balance and achieve peak bone mass, thereby possibly decreasing the risk of fracture when bone is subsequently lost. Calcium intake need not be greater than 800 mg/day during the relatively short period of time between the end of bone building and the onset of bone loss (30 to 40 years). Starting at age 40 to 50, both men and women lose bone slowly, but women lose bone more rapidly around the menopause and for about 10 years after. Intestinal calcium absorption and the ability to adapt to low calcium diets are impaired in many postmenopausal women and elderly persons owing to a suspected functional or absolute decrease in the ability of the kidney to produce 1,25(OH)₂D₂. The bones then become more and more a source of calcium to maintain critical extracellular

fluid calcium levels. Excessive dietary intake of protein and fiber may induce significant negative calcium balance and thus increase dietary calcium requirements. Generally, the strongest risk factors for osteoporosis are uncontrollable (e.g., sex, age, and race) or less controllable (e.g., disease and medications). However, several factors such as diet, physical activity, cigarette smoking, and alcohol use are lifestyle related and can be modified to help reduce the risk of osteoporosis. Author

N91-25573*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

GRAVITY, CALCIUM, AND BONE: UPDATE, 1989

SARA B. ARNAUD and EMILY MOREY-HOLTON /in NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 21-44 May 1991

Avail: NTIS HC/MF A18 CSCL 06E

Some of the results of recent short-term flights and ground-based experiments that have contributed new insights into skeletal adaptation, calcium metabolism, and growth processes in 0 g, are highlighted. After 6 months in space, bone demineralization, invariably involving the os calcis, was found not to extend to the lumbar spine in 4 exercising cosmonauts. A flight experiment in the Space Shuttle crew has documented the early events in the calcium endocrine system during spaceflight. On the ground, brief and long-term bed rest studies of healthy volunteers in the head-down tilt (HDT) model of weightlessness were completed. The skeleton of the adult male responds more rapidly to unloading than previously recognized. Regional changes in bone density can be quantified in only 30 days, are highly individual, and follow the direction of gravitational forces in the HDT model during inactivity. Bone biopsy results in healthy volunteers after bed rest differ from results in paraplegics from the same sampling site. Flight experiments in growing rats reveal changes in the composition of bone mineral and matrix in the femur postflight that were found to be highly regional and suggestive of an effect of gravity on mineral distribution. These observations may be relevant to the results from an earlier Cosmos flight where artificial gravity in space was found to maintain bone strength, but not to correct the radial growth deficit. Author

N91-25574*# Texas Univ., Dallas. Dept. of Internal Medicine. **CARDIOVASCULAR ADJUSTMENTS TO GRAVITATIONAL STRESS**

C. GUNNAR BLOMQUIST and H. LOWELL STONE (Oklahoma Univ., Norman.) /in NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 49-87 May 1991

Avail: NTIS HC/MF A18 CSCL 06E

The effects of gravity on the cardiovascular system must be taken into account whenever a hemodynamic assessment is made. All intravascular pressure have a gravity-dependent hydrostatic component. The interaction between the gravitational field, the position of the body, and the functional characteristics of the blood vessels determines the distribution of intravascular volume. In turn this distribution largely determines cardiac pump function. Multiple control mechanisms are activated to preserve optimal tissue perfusion when the magnitude of the gravitational field or its direction relative to the body changes. Humans are particularly sensitive to such changes because of the combination of their normally erect posture and the large body mass and blood volume below the level of the heart. Current aerospace technology also exposes human subjects to extreme variations in the gravitational forces that range from zero during space travel to as much as nine-times normal during operation of high-performance military aircraft. This chapter therefore emphasizes human physiology. Author

N91-25575*# State Univ. of New York, Buffalo. Dept. of Physiology.

EXPOSURE TO STRESSFUL ENVIRONMENTS: STRATEGY OF ADAPTIVE RESPONSES

LEON E. FARHI /in NASA. Lyndon B. Johnson Space Center,

Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications 121-134 May 1991

Avail: NTIS HC/MF A18 CSCL 06E

Any new natural environment may generate a number of stresses (such as hypoxia, water lack, and heat exposure), each of which can produce strains in more than a single organ system. Every strain may in turn stimulate the body to adapt in multiple ways. Nevertheless, a general strategy of the various adaptive responses emerges when the challenges are divided into three groups. The first category includes conditions that affect the supply of essential molecules, while the second is made up by those stresses that prevent the body from regulating properly the output of waste products, such as CO₂ and heat. In both classes, there is a small number of responses, similar in principle, regardless of the specific situation. The third unit is created by environments that disrupt body transport systems. Problems may arise when there is a conflict between two stresses requiring conflicting adaptive changes. An alternative to adaptation, creation of micro-environment, is often favored by the animal. Author

N91-25576*# California Univ., San Diego, La Jolla.

HEART-LUNG INTERACTIONS IN AEROSPACE MEDICINE

HAROLD J. B. GUY and GORDON KIM PRISK /in NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 149-193 May 1991

Avail: NTIS HC/MF A18 CSCL 06E

Few of the heart-lung interactions that are discussed have been studied in any detail in the aerospace environment, but it seems that many such interactions must occur in the setting of altered accelerative loadings and pressure breathing. That few investigations are in progress suggests that clinical and academic laboratory investigators and aerospace organizations are further apart than during the pioneering work on pressure breathing and acceleration tolerance in the 1940s. The purpose is to reintroduce some of the perennial problems of aviation physiology as well as some newer aerospace concerns that may be of interest. Many possible heart-lung interactions are pondered, by necessity often drawing on data from within the aviation field, collected before the modern understanding of these interactions developed, or on recent laboratory data that may not be strictly applicable. In the field of zero-gravity effects, speculation inevitably outruns the sparse available data. Author

N91-25577*# Sydney Univ. (Australia). Dept. of Physiology.

THREE HIERARCHIES IN SKELETAL MUSCLE FIBRE CLASSIFICATION ALLOTYPE, ISOTYPE AND PHENOTYPE

JOSEPH F. Y. HOH, SUZANNE HUGHES, GREGORY HUGH, and IRENE POZGAJ /in NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 194-205 May 1991

Avail: NTIS HC/MF A18 CSCL 06E

Immunocytochemical analyses using specific anti-myosin antibodies of mammalian muscle fibers during regeneration, development, and after denervation have revealed two distinct myogenic components determining fiber phenotype. The jaw-closing muscles of the cat contain superfast fibers which express a unique myosin not found in limb muscles. When superfast muscle is transplanted into a limb muscle bed, regenerating myotubes synthesize superfast myosin independent of innervation. Reinnervation by the nerve to a fast muscle leads to the expression of superfast and not fast myosin, while reinnervation by the nerve to a slow muscle leads to the expression of a slow myosin. When limb muscle is transplanted into the jaw muscle bed, only limb myosins are synthesized. Thus jaw and limb muscles belong to distinct allotypes, each with a unique range of phenotype options, the expressions of which may be modulated by the nerve. Primary and secondary myotubes in developing jaw and limb muscles are observed to belong to different categories characterized by different patterns of myosin gene expression. By taking into consideration the pattern of myosins synthesized and the changes in fiber size after denervation, 3 types of primary (fast, slow, and intermediate) fibers can be distinguished in rat fast limb muscles. All primaries synthesize slow myosin soon after their formation, but this is

withdrawn in fast and intermediate primaries at different times. After neonatal denervation, slow and intermediate primaries express slow primaries hypertrophy with other fibers atrophy. In the mature rat, the number of slow fibers in the EDL is less than the number of slow primaries. Upon denervation, hypertrophic slow fibers matching the number and topographic distribution of slow primaries appear, suggesting that a subpopulation of the slow primaries acquire the fast phenotype during adult life, but reveal their original identity as slow primaries in response to denervation by hypertrophying and synthesizing slow myosin. It is proposed that within each muscle allototype, the various isotypes of primary and secondary fibers are myogenically determined, and are derived from different lineage of myoblasts. Author

N91-25578*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

EFFECTS OF WEIGHTLESSNESS ON HUMAN FLUID AND ELECTROLYTE PHYSIOLOGY

CAROLYN S. LEACH and PHILIP C. JOHNSON, JR. *In its* Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 210-218 May 1991
 Avail: NTIS HC/MF A18 CSCL 06E

The changes that occur in human fluid and electrolyte physiology during the acute and adaptive phases of adaptation to spaceflight are summarized. A number of questions remain to be answered. At a time when plasma volume and extracellular fluid volume are contracted and salt and water intake is unrestricted, ADH does not correct the volume deficit and serum sodium decreases. Change in secretion or activity of a natriuretic factor during spaceflight is one possible explanation. Recent identification of a polypeptide hormone produced in cardiac muscle cells which is natriuretic, is hypotensive, and has an inhibitory effect on renin and aldosterone secretion has renewed interest in the role of a natriuretic factor. The role of this atrial natriuretic factor (ANF) in both long- and short-term variation in extracellular volumes and in the inability of the kidney to bring about an escape from the sodium-retaining state accompanying chronic cardiac dysfunction makes it reasonable to look for a role of ANF in the regulation of sodium during exposure to microgravity. Prostaglandin-E is another hormone that may antagonize the action of ADH. Assays of these hormones will be performed on samples from crew members in the future. Author

N91-25579*# State Univ. of New York, Buffalo. Dept. of Physiology.

GRAVITATIONAL FORCE AND THE CARDIOVASCULAR SYSTEM

D. R. PENDERGAST, A. J. OLSZOWKA, M. A. ROKITKA, and L. E. FARHI *In NASA*. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 242-253 May 1991
 (Contract NAS9-16042)
 Avail: NTIS HC/MF A18 CSCL 06E

Cardiovascular responses to changes in gravitational force are considered. Man is ideally suited to his 1-g environment. Although cardiovascular adjustments are required to accommodate to postural changes and exercise, these are fully accomplished for short periods (min). More challenging stresses are those of short-term microgravity (h) and long-term microgravity (days) and of gravitational forces greater than that of Earth. The latter can be simulated in the laboratory and quantitative studies can be conducted. Author

N91-25580*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

MACULAR BIOACCELEROMETERS ON EARTH AND IN SPACE

M. D. ROSS, L. CUTLER, G. MEYER, P. VAZIN, and T. LAM (Sterling Federal Systems, Inc., Palo Alto, CA.) *In NASA*. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 261-271 May 1991
 Avail: NTIS HC/MF A18 CSCL 06E

Space flight offers the opportunity to study linear

bioaccelerometers (vestibular maculas) in the virtual absence of a primary stimulus, gravitational acceleration. Macular research in space is particularly important to NASA because the bioaccelerometers are proving to be weighted neural networks in which information is distributed for parallel processing. Neural networks are plastic and highly adaptive to new environments. Combined morphological-physiological studies of maculas fixed in space and following flight should reveal macular adaptive responses to microgravity, and their time-course. Ground-based research, already begun, using computer-assisted, 3-dimensional reconstruction of macular terminal fields will lead to development of computer models of functioning maculas. This research should continue in conjunction with physiological studies, including work with multichannel electrodes. The results of such a combined effort could usher in a new era in understanding vestibular function on Earth and in space. They can also provide a rational basis for counter-measures to space motion sickness, which may prove troublesome as space voyager encounter new gravitational fields on planets, or must re-adapt to 1 g upon return to earth. Author

N91-25583*# Medicine and Dentistry Univ. of New Jersey, Camden. Dept. of Surgery.

METABOLISM OF NONESSENTIAL N15-LABELED AMINO ACIDS AND THE MEASUREMENT OF HUMAN WHOLE-BODY PROTEIN SYNTHESIS RATES

T. P. STEIN, R. G. SETTLE, J. A. ALBINA, D. T. DEMPSEY, and G. MELNICK (Pennsylvania Univ., Philadelphia.) *In NASA*. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 276-284 May 1991
 (Contract NAS9-16874; USPHS-AM-33431)
 Avail: NTIS HC/MF A18 CSCL 06E

Eight N-15 labeled nonessential amino acids plus (15)NH₄Cl were administered over a 10 h period to four healthy adult males using a primed-constant dosage regimen. The amount of N-15 excreted in the urine and the urinary ammonia, hippuric acid, and plasma alanine N-15 enrichments were measured. There was a high degree of consistency across subjects in the ordering of the nine compounds based on the fraction of N-15 excreted (Kendall coefficient of concordance $W = 0.83$, P is less than 0.01). Protein synthesis rates were calculated from the urinary ammonia plateau enrichment and the cumulative excretion of N-15. Glycine was one of the few amino acids that gave similar values by both methods. Author

N91-25584*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

A SYSTEMS APPROACH TO THE PHYSIOLOGY OF WEIGHTLESSNESS

RONALD J. WHITE (Management and Technical Services Co., Houston, TX.), JOEL I. LEONARD, JOHN A. RUMMEL, and CAROLYN S. LEACH *In its* Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 285-300 May 1991
 Avail: NTIS HC/MF A18 CSCL 06E

A systems approach to the unraveling of the complex response pattern of the human subjected to weightlessness is presented. The major goal of this research is to obtain an understanding of the role that each of the major components of the human system plays following the transition to and from space. The cornerstone of this approach is the utilization of a variety of mathematical models in order to pose and test alternative hypotheses concerned with the adaptation process. An integrated hypothesis for the human physiological response to weightlessness is developed. Author

N91-25585*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

PERCEPTION OF THE BODY IN SPACE: MECHANISMS

LAURENCE R. YOUNG *In NASA*. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 301-344 May 1991
 Avail: NTIS HC/MF A18 CSCL 06E

The principal topic is the perception of body orientation and motion in space and the extent to which these perceptual

abstraction can be related directly to the knowledge of sensory mechanisms, particularly for the vestibular apparatus. Spatial orientation is firmly based on the underlying sensory mechanisms and their central integration. For some of the simplest situations, like rotation about a vertical axis in darkness, the dynamic response of the semicircular canals furnishes almost enough information to explain the sensations of turning and stopping. For more complex conditions involving multiple sensory systems and possible conflicts among their messages, a mechanistic response requires significant speculative assumptions. The models that exist for multisensory spatial orientation are still largely of the non-rational parameter variety. They are capable of predicting relationships among input motions and output perceptions of motion, but they involve computational functions that do not now and perhaps never will have their counterpart in central nervous system machinery. The challenge continues to be in the iterative process of testing models by experiment, correcting them where necessary, and testing them again. B.G.

N91-25586*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

GRAVITATIONAL EFFECTS ON BRAIN AND BEHAVIOR

LAURENCE R. YOUNG *In* NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 345-353 May 1991 (Contract NAS9-15343)

Avail: NTIS HC/MF A18 CSCL 06E

Visual, vestibular, tactile, proprioceptive, and perhaps auditory clues are combined with knowledge of commanded voluntary movement to produce a single, usually consistent, perception of spatial orientation. The recent Spacelab flights have provided especially valuable observations on the effects of weightlessness and space flight. The response of the otolith organs to weightlessness and readapting to Earth's gravitation is described. Reference frames for orientation are briefly discussed. B.G.

N91-25587*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.

MIT/CANADIAN VESTIBULAR EXPERIMENTS ON THE SPACELAB-1 MISSION. PART 1: SENSORY ADAPTATION TO WEIGHTLESSNESS AND READAPTATION TO ONE-G: AN OVERVIEW

LAURENCE R. YOUNG, C. M. OMAN, D. G. D. WATT, K. E. MONEY (Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario), B. K. LICHTENBERG, R. V. KENYON, and A. P. ARROTT *In* NASA. Lyndon B. Johnson Space Center, Spacelab Life Sciences 1: Reprints of Background Life Sciences Publications p 346-353 May 1991

Avail: NTIS HC/MF A18 CSCL 06E

Experiments on human spatial orientation were conducted on four crewmembers of Space Shuttle Spacelab Mission 1. The conceptual background of the project, the relationship among the experiments, and their relevance to a 'sensory reinterpretation hypothesis' are presented. Detailed experiment procedures and results are presented in the accompanying papers in this series. The overall findings are discussed as they pertain to the following aspects of hypothesized sensory reinterpretation in weightlessness: (1) utricular otolith afferent signals are reinterpreted as indicating head translation rather than tilt, (2) sensitivity of reflex responses to footward acceleration is reduced, and (3) increased weighting is given to visual and tactile cues in orientation perception and posture control. Results suggest increased weighting of visual cues and reduced weighting of graviceptor signals in weightlessness.

Author

N91-25588# National Inst. for Occupational Safety and Health, Morgantown, WV. Div. of Safety Research.

PERFORMING MOTOR AND SENSORY NEURONAL CONDUCTION STUDIES IN ADULT HUMANS

D. E. NESTOR and R. M. NELSON Sep. 1990 74 p (PB91-152736; DHHS/PUB/NIOSH-90-113) Avail: NTIS HC/MF A04 CSCL 06P

Guidelines were provided for the performance of routine nerve

conduction studies of selected peripheral nerves in adult humans. The manual was the result of three working group meetings. Participants in the working groups included neurophysiologists, therapists, physicians, and allied health professionals recognized for their expertise in electrophysiologic assessment of neuromuscular disorders. The guidelines were meant to serve as a starting point for electrophysiologic assessment procedures for evaluating common motor and sensory neuronal conduction disorders encountered in the workplace. The procedures were intended to be used to objectively assess the motor and sensory neuronal conduction status of adult workers subjected to cumulative trauma, toxic substances, or other factors that could cause acute or chronic neuromuscular disorders. Assessment of unusual and unique problems may require sound, creative modification of the standard procedures. GRA

N91-25589*# Texas A&M Univ., College Station. Dept. of Industrial Engineering.

CHARACTERIZATION OF SLOW AND FAST PHASE

NYSTAGMUS Final Technical Report, 1 Jan. 1990 - 28 Jun. 1991

CHARLES S. LESSARD, CARLOS A. RODRIGUEZ-GARCIA, WING CHAN WONG, JAE J. IM, and GLENN F. SCHMIDT 28 Jun. 1991 191 p

(Contract NAG9-303)

(NASA-CR-188452; NAS 1.26:188452) Avail: NTIS HC/MF A09 CSCL 06P

A current literature review of the analog and digital process of vestibular and optical kinetic nystagmus reveals little agreement in the methods used by various labs. The strategies for detection of saccade (fast phase velocity component of nystagmus) vary between labs, and most of the process have not been evaluated and validated with a standard database. A survey was made of major vestibular labs in the U.S. that perform computer analyses of vestibular and optokinetic reflexes to stimuli, and a baseline was established from which to standardize data acquisition and analysis programs. The concept of an Error Index was employed as the criterion for evaluating the performance of the vestibular analysis software programs. The performance criterion is based on the detection of saccades and is the average of the percentages of missed detections and false detections. Evaluation of the programs produced results for lateral gaze with saccadic amplitude of one, two, three, five, and ten degrees with various signal-to-noise ratios. In addition, results were obtained for sinusoidal pursuit of 0.05, 0.10, and 0.50 Hz with saccades from one to ten degrees at various signal-to-noise ratios. Selection of the best program was made from the performance in the lateral gaze with three degrees of saccadic amplitude and in the 0.10 Hz sinusoid with three degrees of saccadic amplitude. Author

N91-25590 Maryland Univ., College Park.

PREDICTION OF MUSCULAR SYNERGISM AND ANTAGONISM OF HUMAN UPPER EXTREMITY: A DYNAMIC OPTIMIZATION APPROACH Ph.D. Thesis

YOHANAN GIAT 1990 358 p

Avail: Univ. Microfilms Order No. DA9110298

A simulation of the skeletal and muscular dynamics of the upper extremity was conducted in an attempt to compute the activity which occurs in each muscle when a comfortable movement is performed. The right upper extremity was modeled as a two-bar linkage moving in the vertical plane of the scapula. The musculo-tendon actuation system was modeled in terms of twelve muscles moving in three-dimensional space. Each muscle was governed by two ordinary differential equations: one for its mechanism and another for its activation. The analysis revealed forty ordinary differential equations governing the dynamics of the upper extremity. Specific muscle parameters were obtained by performing a cadaver dissection; specific skeleton parameters were taken from three-dimensional anthropometric measurements. These parameters were then scaled to fit each subject. The muscle activity was then computed utilizing a bang-bang optimal control procedure, while the muscular stress, joint constraint forces and neural excitation were minimized. The results obtained from the

simulation program describe all the dynamic events that take place in the upper extremity when the investigated movement is attempted. The computed results reveal that the upper extremity performed the expected motion in a way somewhat similar to that which had been recorded experimentally. The computed muscle tension histories describe the synergistic and antagonistic activities that occur in the upper extremity when the simulated movement takes place. Recommendations are made to include in the model the effect of the bony and ligamentous support; to modify the cost function and the activation model so that a nonlinear, as opposed to a bang-bang, optimal control algorithm is used; and to economize the overall computation, particularly that of the costate vector.

Dissert. Abstr.

N91-25591# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

29 Mar. 1991 65 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-008) Avail: NTIS HC/MF A04

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: biochemistry, biophysics, biotechnology, epidemiology, immunology, laser bioeffects, medicine, microbiology, molecular biology, public health, and radiobiology.

N91-25592# Joint Publications Research Service, Arlington, VA.
FEATURES OF OPTOKINETIC, OPTOOCULOMOTOR AND VESTIBULOOCULOMOTOR RESPONSES IN WEIGHTLESSNESS

L. N. KORNILOVA and G. BODO *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1-5 29 Mar. 1991 Transl. into ENGLISH from *Vestnik Otorinolaringologii* (Moscow, USSR), no. 3, May - Jun. 1990 p 37-43

Avail: NTIS HC/MF A04

The results are presented of a study of optooculomotor and vestibulooculomotor responses in weightlessness during the Optokinez experiment, which was carried out in 1984 during the seven-day mission of Soviet-Indian crew and during the 237-day mission aboard the Salyut-7 station. The objectives of the experiment were to study spontaneous oculomotor activity and the effect of optokinetic stimulation (OKS) on it; assess fixational rotation and tracking movements of the eyes; determine threshold and above-threshold sensitivity of oculomotor function to graded OKS in different directions; assess vestibulooculomotor responses to primarily otolith stimulation (rocking the head in the frontal plane) and ampullar stimulation (rocking the head about the longitudinal axis); assess the effect of active head movements on optooculomotor responses; and investigate adaptation of sensory systems to weightlessness from oculomotor responses to vestibular stimulation and OKS.

Author

N91-25593# Oak Ridge National Lab., TN.
RADIATION SHIELDING REQUIREMENTS FOR MANNED DEEP SPACE MISSIONS

R. T. SANTORO and D. T. INGERSOLL Apr. 1991 25 p (Contract DE-AC05-84OR-21400)

(DE91-010723; ORNL/TM-11808) Avail: NTIS HC/MF A03

Galactic cosmic rays (GCR) and, particularly, solar flares (SF) constitute the major radiation hazards in deep space. The dose to astronauts from these radiation sources and the shielding required to mitigate its effect during a 480 day Mars mission is estimated for a simplistic spacecraft geometry. The intent is to ballpark the magnitude of the doses for the constant GCR background and for SF's that occur randomly during the mission. The spacecraft shielding and dose data are given only for primary GCR and SF radiation, recognizing that secondary particles produced by primary particle reactions in the spacecraft and High Z-High Energy particles will also contribute to the dose suffered by the astronauts.

DOE

N91-25594# Oak Ridge National Lab., TN.
RADIO FREQUENCY BIOLOGICAL HAZARDS AND MEASUREMENT TECHNIQUES

M. R. MOORE 1991 7 p Presented at the 1991 European Muon Collaboration (EMC) Expo, Orlando, 25-27 Jun. 1991 (Contract DE-AC05-84OR-21400)

(DE91-010776; CONF-9106168-1) Avail: NTIS HC/MF A02

An introduction is given that includes natural radio frequency (RF) sources, natural energy produced by the body, and how these compare to domestic exposure standards. Thermal and athermal biological effects of RF fields including known effects and others still under investigation are discussed. Applicable domestic and foreign exposure standards are compared. Also, specific examples are given of public concerns that have arisen. Various instrumentation for quantifying the electromagnetic field levels is described, as well as the manner in which these instruments can be used to survey the field levels present in a given area. DOE

N91-25595# Lawrence Livermore National Lab., CA.
HEALTH RISKS FROM EXPOSURE TO TRITIUM

T. STRAUME 22 Feb. 1991 68 p

(Contract W-7405-ENG-48)

(DE91-011008; UCRL-LR-105088) Avail: NTIS HC/MF A04

Estimates of the health risks in humans from low level exposure to tritiated water (sup 3)HOH or organically bound tritium (OBT) are presented. The health risks considered are those for cancer, genetic effects, developmental effects, and reproductive effects. Because direct risk information for these effects is not available from human exposures to tritium, a three step approach was used. First, excess risks for the above effects following low level exposure to x rays or gamma rays were estimated from available human epidemiological data, using appropriate dose-rate effectiveness factors (DREFs). Second, through detailed review of the tritium relative biological effectiveness (RBE) data from laboratory studies, best-estimate RBEs for these classes of effects were obtained for tritium. Finally, the human risk estimates for low-level x rays or gamma rays were multiplied by the appropriate best estimate RBEs for tritium, taking into account differences in effectiveness of comparison radiations. The resultant lifetime risk coefficients for low level exposure to (sup 3)HOH are presented. The risks from exposure to OBT molecules are estimated to range from values that are similar to those for (sup 3)HOH to about a factor of two higher.

DOE

N91-25596# Argonne National Lab., IL.
PROTECTION AGAINST UVA-INDUCED PHOTOOXIDATIVE DAMAGE IN MAMMALIAN CELL LINES EXPRESSING INCREASED LEVELS OF METALLOTHIONEIN

E. J. DUDEK, J. G. PEAK, M. J. PEAK, and R. M. ROTH (Illinois Inst. of Tech., Chicago.) 1990 7 p Presented at the 5th Biennial Meeting on Oxidative Damage and Repair, Pasadena, 14-20 Nov. 1990

(Contract W-31-109-ENG-38)

(DE91-010791; ANL/CP-70911; CONF-9011196-1) Avail: NTIS HC/MF A02

Metallothionein (MT) is an endogenous low molecular weight protein that is inducible in a variety of eukaryotic cells and has the ability to selectively bind heavy metal ions such as zinc and the cadmium. Although the exact physiological role of MT is still not understood, there is strong evidence that MT is involved in providing cellular resistance against the damaging effects of heavy metals and in the regulation of intracellular zinc and copper. Recently, it has been demonstrated that MT can scavenge radiation-induced reactive oxygen intermediates in vitro, specifically hydroxyl and superoxide radicals, and because of these observations it has been suggested that MT may provide protection against radiation-induced oxidative stress in vivo. Cell lines expressing increased levels of MT have demonstrated resistance to ionizing radiation, to ultraviolet radiation, and also to various DNA damaging agents including melphalan and cis-diamine-dichloroplatinum. It is therefore important to gain some insight into the relationship between cellular MT content and cellular resistance to radiation and other DNA damaging agents. In this

study we investigated the role of MT in providing protection against monochromatic 365-nm UVA radiation, which is known to generate intracellular reactive oxygen species that are involved in both DNA damage and cell killing. For this purpose, we used zinc acetate, a potent inducer of MT, to elevate MT levels in V79 Chinese hamster fibroblasts prior to UVA exposure and determined cell survival for uninduced and induced cultures. In order to eliminate any zinc effects other than MT induction, we also isolated and characterized cadmium chloride-resistant clones of V79 cells that have increased steady-state levels of both MT mRNA and protein, and we examined their survival characteristics against 365-nm radiation in the absence of zinc acetate. DOE

N91-25597# Columbia Univ., New York, NY.
LOW DOSE NEUTRON LATE EFFECTS: CATARACTOGENESIS
 B. V. WORGUL Apr. 1991 5 p
 (Contract DE-FG02-90ER-61009)
 (DE91-011020; DOE/ER-61009/1) Avail: NTIS HC/MF A01

The work is formulated to resolve the uncertainty regarding the relative biological effectiveness. The endpoint which is being utilized is cataractogenesis. The advantages conferred by this system stems primarily from the non-invasive longitudinal analysis which it allows. It also exploits a well defined system and one which has demonstrated sensitivity to the inverse dose rate effect observed with heavy ions. Four week old-rats were divided into 8 dose groups which received single or fractionated total doses of 0.2, 1.0, 5.0, and 25 cGy of monoenergetic 435 keV neutrons. Special restraining jigs were devised to insure that the eye at the midpoint of the lens received the appropriate energy and dose with a relative error of + or - 5 percent. The fractionated regimen consisted of four exposures, each administered at 3 hour intervals. The reference radiations, 250 kVp x rays, were administered in the same fashion but in doses ranging from .5 to 6.0 Gy. The animals are examined on a bi-weekly basis utilizing conventional slit-lamp biomicroscopy and the Scheimpflug Slit-lamp Imaging System. The follow-ups will continue throughout the lifespan of the animals. When opacification begins full documentation will involve the Zeiss imaging system and Oxford retroillumination photography. The processing routinely employs the Merriam/Focht scoring system for cross-referencing with previous cataract studies and establish cataractogenesis using a proven scoring method. DOE

N91-25598# Boston Univ., MA. Dept. of Chemistry.
SCINTILLATION MATERIALS FOR MEDICAL APPLICATIONS
 A. LEMPICKI, A. J. WOJOWICZ, and E. BERMAN 1991 28 p
 (Contract DE-FG02-90ER-61033)
 (DE91-011022; DOE/ER-61033/1) Avail: NTIS HC/MF A03

This report covers the first seven months of the first year of work under the above Grant. As such, it is rather preliminary. The concrete steps taken to implement the program are described. In Section 2 the progress towards the development of the instrumentation and facilities needed to conduct the work and the materials which have been acquired, is described. In Section 3 an account is given on preliminary measurements which have already been made as well as some calculations aimed at interpreting experimental results. Additionally the general way of thinking about the problem of improving scintillator materials is expanded. This subject is covered in the Appendix Scintillator Research, which is an evolving document, not to be regarded as finished. In fact the last section cannot be finished in time for this report. We believe it serves the dual purpose of articulating the research goals and priorities for the purposes and at the same time to communicating them to the sponsor. DOE

N91-25599# Los Alamos National Lab., NM.
RADIATION EXPOSURE AND PROTECTION FOR MOON AND MARS MISSIONS
 R. E. MACFARLANE, R. E. PRAEL, D. D. STROTTMAN, G. F. STRNISTE, and W. C. FELDMAN Apr. 1991 18 p
 (Contract W-7405-ENG-36)
 (DE91-011346; LA-11904-MS) Avail: NTIS HC/MF A03

A deep space radiation environment of galactic cosmic rays

and energetic particles from solar flares imposes stringent requirements for radiation shielding for both personnel and electronic equipment at a moon base or on a Mars expedition. Current Los Alamos capabilities for calculating the effect of such shielding are described, and extensions and validation needed before actual manned deep space missions are launched are outlined. The biological effects of exposure to cosmic-ray ions and to low doses of radiation at low dose rates are poorly understood. Recent Los Alamos work on mutation effects in cells, DNA repair processes, and the analysis of chromosomal aberrations promises to increase our understanding of the basic processes, to provide methods to screen for radiation sensitivity, and to provide advanced dosimetry equipment for space missions. DOE

N91-25600* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 350)
 Jun. 1991 56 p
 (NASA-SP-7011(350); NAS 1.21:7011(350)) Avail: NTIS HC A03; NTIS standing order as PB91-912300, \$15.00 domestic, \$30.00 foreign CSCI 06E

This bibliography lists 152 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during May 1991. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance. Author

N91-25603# Hamburg Univ. (Germany, F.R.). Dept. of Eyes.
LASER EFFECTS UPON THE STRUCTURE AND FUNCTION OF THE EYE AS A FUNCTION OF DIFFERENT WAVELENGTHS
 J. DRAEGER, R. SCHWARTZ, and C. STERN *In* AGARD, Ocular Hazards in Flight and Remedial Measures 4 p May 1991
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A laser produces a narrow beam of monochromatic, coherent light in the visible, infrared, or ultraviolet parts of the spectrum. The power in a continuous beam can range from a fraction of a milliwatt to more than a megawatt. The applications and range of laser devices is broad. Helium-neon, argon, carbon dioxide, excimer, neodymium, and YAG lasers are described. The attendant hazards of laser operations vary greatly depending upon the exact type of laser and its application. The effects of optical radiation on the eye vary significantly with wavelength. Injuries to the anterior and posterior part of the eye are described. Prevention of laser-induced injuries are briefly discussed. Author

N91-25604# Army Aeromedical Research Lab., Fort Rucker, AL. Visual Sciences Branch.
ULTRAVIOLET RADIATION EFFECTS ON THE CORNEAL EPITHELIUM
 MORRIS R. LATTIMORE, JR. *In* AGARD, Ocular Hazards in Flight and Remedial Measures 5 p May 1991
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Since military troops are involved in extensive outdoor activities with chronic exposure to solar radiation, and since ultraviolet radiation (UVR) lasers may play a role in the future military environment, a thorough understanding of UVR damage mechanisms is crucial to the development of intervention and treatment modalities. The present research was directed at quantifying possible alterations in corneal epithelial metabolic activity secondary to in-vivo exposure to UVR in the rabbit. Author

N91-25605# Institute of Aviation Medicine, Fuerstenfeldbruck (Germany, F.R.).
EYE DAMAGE INDUCED BY SOLAR RADIATION
 H. BRANDL and F.-J. DAUMANN *In* AGARD, Ocular Hazards in Flight and Remedial Measures 5 p May 1991

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With the current methods including color vision tests with the Hue-test 100 no eye damages in the blue-light spectrum of solar radiation could so far be verified in flight filtering effect and a complete blocking in the UV-spectrum most likely provide adequate protection. The previous experience, however, should not keep one from striving for refinement of examination methods especially in the blue-light spectrum in order not to overlook insidious damage. The point is to avoid phototoxic damage. It is the task to provide safety for the pilot; this can be achieved by an advancement of knowledge, measuring methods, and consequent actions. Author

N91-25608# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

A TWO CLASS MODEL FOR PHOTOCHEMICAL DAMAGE OF THE RETINA

D. VANNORREN *In* AGARD, Ocular Hazards in Flight and Remedial Measures 4 p May 1991

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A basic understanding of the mechanisms involved in photochemical damage to the eye is needed. The focus is on retinal light hazards mediated by photochemical processes, and related to exposures lasting from a few seconds to one or two days. It is proposed that from a simple model with two retinal photosensitizers, the shape of the threshold curve for light damage can be predicted. Because the action spectrum for light damage is also known from this model, the damage threshold can be calculated for an arbitrary light source. Author

N91-25610# Office of the Air Force Surgeon General, Washington, DC.

USE OF CONTACT LENSES (CL) BY AIRCREW IN THE USAF Progress Report

THOMAS M. MCNISH *In* AGARD, Ocular Hazards in Flight and Remedial Measures 4 p May 1991

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In Jun. 1989, the Chief of Staff, USAF approved a plan authorizing, for the first time, the use of corrective CL (contact lenses) in flight by aircrews of the USAF. Eligible aircrew under this plan include all those requiring distant vision correction and having less than 2 diopters astigmatism. There is a recognized operational advantage to the use of CL vice spectacles in several air force missions. These include, most notably, the operation of high performance aircraft, and/or the use of night vision goggles to accomplish the mission. Therefore, the use of CL in flight is now optional for all physically qualified aircrew in the USAF. Prior to initiation of this program, a thorough literature search was accomplished. Based on data from studies on the complications associated with CL, the loss of 70 flying days per 1000 CL wearing aviators and four permanent groundings per 10000 CL-wearing aviators per year were predicted from CL-related problems. Safety of flight in high performance aircraft with CL was determined by a 1-year study of 89 aviators in Tactical Air Command, completed in 1989. Complication rates were very close to those predicted. In order to further validate predictions, or rapidly detect any negative trends, the implementation plan includes a requirement for close professional followup of all CL-wearing aviators. Detailed quarterly reports on total number of CL-wearing aircrew, CL-related medical groundings, safety incidents, etc., are required by the Surgeon General, USAF. So far, there have been no permanent groundings nor CL-related safety incidents. After 856 aircrew-years of CL use, the rate of temporary grounding remains close to early predictions. Author

N91-25611# Army Aeromedical Research Lab., Fort Rucker, AL. Visual Sciences Branch.

CONTACT LENSES IN THE US ARMY ATTACK HELICOPTER ENVIRONMENT

MORRIS R. LATTIMORE, JR. *In* AGARD, Ocular Hazards in

Flight and Remedial Measures 3 p May 1991

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Recent technological advances have had a major impact on military aviation. While modern methods of providing visual information via electro-optics/visionics systems have extended the aviator's operational envelope, these devices are becoming increasingly incompatible with spectacle wear. Since approximately 20 percent of Army aviators are ametropic (spectacle wearing), alternative means of providing a refractive error correction need to be investigated. One alternative being considered is the use of a contact lens correction. For the past year, the U.S. Army Aeromedical Research Laboratory (USAAEL) has been conducting a worldwide, AH-64 Apache contact lens research project in order to develop a comprehensive database on contact lens wear in a variety of environments. A three-tier contact lens fitting system is being used: two different types of soft lenses and one rigid gas permeable (RGP) lens type. The wearing schedule is set at a maximum of 7 days/6 nights of extended lens wear. Fundamental operational data is being chronicled by unit flight surgeons. Standard clinical data is being used in on-going command deliberations on future medical policy decisions concerning contact lens wear by Army aviators. Basic research information is being gathered in an effort to determine the fundamental physiological response to the cornea to the presence of a contact lens. Up-to-date results are presented as an introduction to interactive discussions. The subjective assessment of contact lens applications within the aviation community is universal acceptance. While current clinical data indicate some ocular health risk, flight safety risks are minimal. Establishment of long-term contact lens efficiency likely will depend on the ensuing analysis of physiological data. Author

N91-25612# Royal Air Force, London (England).

TEN YEARS FLYING WITH SOFT CONTACT LENSES

J. K. CLOHERTY *In* AGARD, Ocular Hazards in Flight and Remedial Measures 12 p May 1991

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In 1980 the RAF started an Aircrew Soft Contact Lenses (ASCL) Trial, Phase 1, to assess the value and safety of soft contact lenses for those aircrew who wear corrected flying spectacles (CFS). For this trial two soft contact lenses were selected. The high water content Scanlens 75 and the Medium water content Snoflex 50. The volunteers were selected from aircrew and medical officers. The subjects were measure (pre-fitting and post-fitting) and exposed to adverse environmental conditions likely to be encountered in flight. In all instances, the visual performance wearing soft contact lenses did not differ significantly from their performance when wearing CFS. In 1981 the Snoflex 50 lenses were abandoned because they were unsuitable for extended wear. In 1985 the care regime of the Scanlens 75 was changed to the SEPTICON care system. It was concluded that soft contact lenses are a viable and worthwhile alternative to CFS for aircrew. B.G.

N91-25613# Rigshospitalet, Copenhagen (Denmark). Dept. of Aviation Medicine.

SOFT CONTACT LENS WEAR AND AVIATION

STEEN TINNING and JANNIK BOBERG-ANS *In* AGARD, Ocular Hazards in Flight and Remedial Measures 3 p May 1991

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Soft contact lenses were proposed as an alternative to spectacles, when refractive errors are corrected in high performance fighter pilots. In the present study the effect on visual acuity was examined, when soft contact lenses were used during altitude simulated flying within a low pressure chamber. It can be concluded, that neither visual acuity nor visual comfort are effected by the use of soft contact lenses. Based on the experience from one pilot, soft contact lenses seems to be superior to spectacles when refractive errors has to be corrected in high performance fighter pilots. Author

N91-25614# Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Crew Systems Effectiveness Branch.
EFFECT OF AIRCRAFT CABIN ALTITUDE AND HUMIDITY ON OXYGEN TENSION UNDER SOFT AND HARD GAS-PERMEABLE CONTACT LENSES

MELVIN R. ONEAL *In* AGARD, Ocular Hazards in Flight and Remedial Measures 9 p May 1991

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The primary source of oxygen to the cornea is from the ambient air. Contact lenses decrease the oxygen getting to the corneal surface; and below a critical oxygen level corneal hypoxia occurs and the cornea swells. Repeated corneal edema may be implicated in the adverse effects of extended contact lens wear. The military flying environment includes aircraft cabin pressure that is decreased from normal sea level and cabin humidity that is usually much lower than normal. A calculational approach was used to access the effect of various cabin environments on oxygen levels under both soft and hard gas-permeable (HGP) contact lenses. The oxygen tension under 55 percent and 71 percent H₂O soft lenses during normal wear and at 18 percent relative humidity and under HGP lenses of various oxygen transmissibility was calculated for 8000 and 16000 ft cabin altitudes. Both altitude and dehydration affect the oxygen under soft lenses, while hard lenses do not dehydrate and have the benefit of added oxygen with tear exchange during blinking. The calculated oxygen tension under the hard lens is 2 to 3 times that under soft lenses at all cabin altitudes. In normal soft lens extended wear the cornea deswells the following day; however, during flight, the lower oxygen under soft lenses could affect corneal recovery in aircrew. The cabin environment is shown to result in calculated oxygen levels under contact lenses that are substantially reduced from normal, and needs consideration.

Author

N91-25615# Institute of Aviation Medicine, Fuerstenfeldbruck (Germany, F.R.).

INTRA-OCULAR LENSES AND MILITARY FLYING QUALIFICATIONS

F.-J. DAUMANN and H. BRANDL *In* AGARD, Ocular Hazards in Flight and Remedial Measures 4 p May 1991

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The development of intra-ocular lenses (IOLs) to the present day routine implantation was accompanied by mixed emotions. In order to understand this reception, a brief history of cataract surgery is discussed. In 1975 IOL's were implanted at a more favorable site. Lens design and materials were considerably improved, the surfaces polished, sterilization and instruments improved. Now an assessment of the qualifications for military flying duty was made by examining aircrew and their performance (with IOLs). It was decided that in assessing whether flight crews should be granted waivers after cataract surgery with IOLs, that the surgery as such cannot meet the requirement. Each case must be evaluated separately. The following criteria must be met: visual acuity must be 1.0; no measurable disturbance through glare; intra-ocular eye pressure must be normal; and no inflammatory process.

B.G.

N91-25616# School of Aerospace Medicine, Brooks AFB, TX. Ophthalmology Branch.

CATARACT SURGERY AND INTRAOCULAR LENSES IN USAF AVIATORS

DEBRA L. MOORMAN and ROBERT P. GREEN *In* AGARD, Ocular Hazards in Flight and Remedial Measures 6 p May 1991

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More than one million cataract surgeries, most with implantation of intraocular lenses, are performed in the United States each year. The early data on the United States Air Force's prospective study on the use of these surgical techniques in its military flyers are presented. From 1979 to 1990, 23 military aviators were evaluated by the United States Air Force School of Aerospace Medicine (USAFSAM) after cataract extraction with intraocular lens

implantation. Their USAFSAM evaluation records were reviewed. Long-term follow-up (greater than 3 years) was available on only 3 subjects. All 23 subject were male Caucasians, with a mean age of 43 years. Ninety-one percent of the subjects were pilots, and, of these, 8 were qualified in high-performance aircraft. There were a total of 28 eyes, 86 percent (24) of which had received extracapsular cataract extractions (ECCE) with posterior chamber lenses. Best-corrected, postoperative vision was 20/20 or better in 100 percent of the eyes. Posterior capsule opacification occurred in 60 percent of the ECCE eyes, with one-third of those requiring Nd:YAG laser capsulotomies. Only one aviator was disqualified from flying duties for ocular reasons, a visually-qualified-to-fly rate of 96 percent. Eight aviators have actually flown since surgery. Although follow-up was short, the initial results are very encouraging.

Author

N91-25617# Rigshospitalet, Copenhagen (Denmark). Dept. of Aviation Medicine.

CONTRAST SENSITIVITY AND GLARE FOLLOWING KERATOTOMY

STEEN TINNING *In* AGARD, Ocular Hazards in Flight and Remedial Measures 3 p May 1991

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During the later years radial keratotomy has been proposed as a possibility for young myops to obtain adequate visual acuity to fulfill the visual requirements for military pilots. Post keratotomy applicants are never the less not usually accepted as pilots, due to reports describing reduced visual functions, increased sensitivity to glare, and unstable refraction following keratotomy. With the purpose to evaluate the visual problems following keratotomy, a number of postkeratotomy applicants has been referred to the eye-clinic at the Department of Aviation Medicine for extended eye-examination. Refraction was stable in all eyes but one. The visual functions at low illumination was reduced in one third of the eyes, and more than half of the eyes had reduced contrast sensibility during radial glare. It is generally advised not to accept postkeratotomy patients as pilots. Demonstrated stability of refraction and acceptable visual function during glare and reduced illumination should be regarded as minimum requirement, if a postkeratotomy patient is to be accepted as an aviator.

Author

N91-25618# Institute of Ophthalmology, London (England). Dept. of Clinical Ophthalmology.

A SURVEY OF COLOUR DISCRIMINATION IN GERMAN OPHTHALMOLOGISTS: CHANGES ASSOCIATED WITH THE USE OF LASERS AND OPERATING MICROSCOPES

G. B. ARDEN, T. BERNINGER, C. R. HOGG, and E. LUND (Munich Eye-Hospital, Germany, F.R.) *In* AGARD, Ocular Hazards in Flight and Remedial Measures 6 p May 1991 Sponsored in part by Wellcome Trust and Wolfson Foundation

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Color vision tests were performed on 211 German ophthalmologists during their annual meeting at Essen. The subjects also filled in detailed questionnaires about their use of lasers and operating microscopes, and their ocular and general health. It was found that compared to those doctors who do not use lasers or operating microscopes, 33 percent of those who do have decreased color discrimination, for colors in a tritan color-confusion axis (greater than 2SD above normal). There is a relationship between number of patients treated and the degree of threshold elevation. Thirty hours of use of the operating microscope produces an increase in tritan threshold equivalent to 1 panretinal photocoagulation. After treating between 1000 to 10000 patients with Argon lasers, the average color threshold will be greater than 2SD above the normal mean. There is an important additional source of variation of color vision in surgeons who use lasers, due to a factor which apparently offers protection against light hazard.

Author

N91-25619# School of Aerospace Medicine, Brooks AFB, TX. Human Systems Div.

MEDICAL MANAGEMENT OF COMBAT LASER EYE INJURIES
ROBERT P. GREEN, JR., ROBERT M. CARTLEDGE, FRANK E. CHENEY, and ARTHUR R. MENENDEZ *In* AGARD, Ocular Hazards in Flight and Remedial Measures 7 p May 1991

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The rapid growth of laser science and engineering has resulted in an increased use of lasers by the military. It is likely that in future engagements lasers will be used directly against the forces, and their effects on the health and mission performance of the aircrews are of particular concern. Since the optics of the eye can increase the retinal irradiance by a factor of 100,000 times over that which is incident at the cornea, the retina is especially vulnerable. Laser range finders and target designators are used in military operations, and energy inputs from these and other potential laser sources are sufficient to produce significant eye injury at distances of 1 km or more. Glare and flashblindness, which are temporary visual effects caused by visible lasers, are present for laser energies considerably below the damage threshold and can, therefore, interfere with mission performance at considerable longer range. Aircrews partially protected by windscreens and canopies are still at risk from near infrared and visible lasers, while other personnel, such as air base ground defense forces, are additionally at risk from ultraviolet and far infrared lasers. Patients' symptoms from laser exposure will vary depending upon the power and wavelength of the laser, the structure of the eye affected, how close the exposure was to the visual axis, and the extent of the temporary or permanent effects on visual structures. Since most medical personnel in the field have never previously dealt with a patient who has had a laser exposure, a report which provides background information on lasers and guidance on handling these patients was written. Author

N91-26178# Joint Publications Research Service, Arlington, VA.
REVIEW OF PRIMARY MEDICAL RESULTS OF YEAR-LONG FLIGHT ON MIR STATION

A. I. GRIGORYEV, S. A. BUGROV, V. V. BOGOMOLOV, A. D. YEGOROV, I. B. KOZLOVSKAYA, I. D. PESTOV, and I. K. TARASOV *In its* JPRS Report: Science and Technology. USSR: Space p 42-49 16 Apr. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (USSR), v. 24, no. 5, Sep.-Oct. 1990 p 3-10

Avail: NTIS HC/MF A06

The objective of medical investigations during and after the 366 day manned mission was to accumulate information about human responses to long-term effects of microgravity. To do this, cardiovascular and other systems were examined in detail during and after exposure. The results gave evidence that the crewmembers well adapted to the long-term flight effects. Their good health and high work capacity were supported by adequate medical procedures. Postflight readaptation developed similarly to what was seen after previous flights of shorter duration (6 to 11 months). No qualitatively new changes in the physiological systems were detected during or after this mission. Author

N91-26683# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

6 May 1991 86 p Transl. into ENGLISH of various Russian articles

(JPRS-ULS-91-010) Copyright Avail: NTIS HC/MF A05

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, biochemistry, biotechnology, epidemiology, medicine, microbiology, physiology, public health, radiobiology, and virology.

N91-26684# Joint Publications Research Service, Arlington, VA.
PHARMACOLOGICAL CORRECTION OF FUNCTIONAL CONDITION OF ARMY AIR FORCE FLYERS IN HOT CLIMATE WITH ASPARKAM Abstract Only

A. A. BOCHENKOV and V. A. CHVYAKIN *In its* JPRS Report:

Science and Technology. USSR: Life Sciences p 1-2 6 May 1991 Transl. into ENGLISH from Voenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 7, Jul. 1990 p 62-63

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Unfavorable conditions for flight personnel arise when crews fly modern aircrafts in a regions with a hot climate. The complex of climatic and geographical factors in such zones has a pronounced influence on the mechanisms of thermoregulation and the activity of systems such as cardiovascular system. Increasingly, a determination of the activity of succinate dehydrogenase (SDH) of the lymphocytes, a key enzyme of tissue respiration, was used to characterize the functional condition of the body. The drug Asparkam was used to adjust the functional condition of the flyer's body, in a dosage of one tablet three times per day for one month. The influence of the drug Asparkam in the flyer's body consisted of a positive trend in metabolic shifts and improved functional conditions of the body. Author

N91-26685# Joint Publications Research Service, Arlington, VA.
RISK FACTORS AND PREDICTION OF SYNCOPIC STATES IN FLYERS Abstract Only

B. KH. SEMENOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2 6 May 1991 Transl. into ENGLISH from Voenno-Meditsinskiy Zhurnal (Moscow, USSR), no. 7, Jul. 1990 p 63

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On the basis of many years of investigation and clinical observation by specialists of civil aviation, risk factors were identified for the development of syncope in flyers - vascular and cardiac factors, the composition of the blood, autonomic tonus, factors which weaken the body, etc. The clinical data of 120 flight personnel were studied. On the basis of the findings of a correlation analysis, significant factors were discerned and given a rating on a point scale in accordance with the degree of closeness of the correlation curve. Author

N91-26686# Joint Publications Research Service, Arlington, VA.
SURVEY OF THE PRINCIPAL RESULTS OF MEDICAL RESEARCH IN THE FLIGHT PROGRAM OF THE SECOND MAIN EXPEDITION ABOARD THE MIR ORBITING COMPLEX Abstract Only

O. G. GAZENKO, A. I. GRIGORYEV, S. A. BUGROV, A. D. YEGOROV, V. V. BOGOMOLOV, I. B. KOZLOVSKAYA, and I. K. TARASOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2-3 6 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 3-11

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The mission of the second main expedition aboard the Mir/Soyuz-TM/Kvant/Progress orbiting complex is described. The scientific flight program included continuing study of Earth resources and conduct of meteorological, astrophysical, geophysical, biomedical, and other research. The scientific medical program consisted primarily in continuing and expanding research on the phenomenology and mechanisms of change in the conditions of the principal body systems in the various stages of a long flight and after the flight is over. Author

N91-26687# Joint Publications Research Service, Arlington, VA.
STATE-OF-THE-ART AUTOMATED EVALUATION OF FUNCTIONAL STATE OF THE BODY IN THE SPACE PROGRAM AND PREVENTIVE MEDICINE Abstract Only

B. A. ADAMOVICH, R. M. BAYEVSKIY, A. P. BERSENEVA, and I. I. FUNTOVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 11-18 6 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 11-18

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A scale consisting of four gradations of functional capacity was developed to evaluate adaptational potential (level of health): (1) high or adequate functional capacities of the body, satisfactory adaptation to environmental conditions; (2) a state of exertion of adaptive mechanisms that ensure sufficient functional capacities

through the mobilization of additional functional reserves; (3) lowered functional capacities of the body, unsatisfactory adaptation to environmental conditions; and (4) low or minimal functional capacities of the body, failure of adaptation. The development of automated information analysis systems is discussed. One of the important objectives is the standardization and automation of the evaluation of the results of medical monitoring, which considerably raises the objectivity of medical conclusions concerning the body's functional capacities. Author

N91-26688# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

18 Apr. 1991 88 p Transl. into ENGLISH of various Russian articles

(JPRS-ULS-91-009) Avail: NTIS HC/MF A05

Abstracts and brief reports on a number of topics relative to life sciences research in the U.S.S.R. are given. Topics covered include aerospace medicine, insecticides, biochemistry, biophysics, epidemiology, genetics, human factors engineering, radiation effects, toxicology, pharmacology, physiology, public health, radiation biology, and virology.

N91-26689# Joint Publications Research Service, Arlington, VA.
HORMONAL REGULATORS OF CALCIUM METABOLISM FOLLOWING SPACE FLIGHTS OF VARIOUS DURATIONS Abstract Only

L. G. POZHARSKAYA and V. B. NOSKOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 18 Apr. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya and Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 18-20

Avail: NTIS HC/MF A05

The degree of parathormone, calcitonin, and gastrin system activity depending in the duration of weightlessness conditions was compared in 19 cosmonauts, 12 of which had seven-day flights, and 7 of which had flights lasting from 150 to 237 days. Blood samples were drawn 30 days before departure and 1, 7, and more days following arrival with the parathormone, calcitonin, and gastrin concentrations calculated using standard commercial test kits. Members of the short-term flight group exhibited a 45 percent average elevation in calcitonin, and a 44 percent gastrin content increase, while parathormone levels remained essentially unchanged. In members of the long-term flight group, parathormone levels were quite elevated and did not return to normal until 45 days after landing. Calcitonin levels were substantially depressed and in some subjects did not return to baseline levels by the end of the research period (45 days after landing). Gastrin levels were 3.3 times higher than pre-flight concentrations, and normalized within 45 days after returning to earth. The results demonstrated that parathormone and calcitonin help maintain calcium homeostasis by their opposite effects on calcium transport in the intestines and kidneys. The findings suggest that one of the reasons for hypergastrinemia following space flight may be the elevated parathormone level and abrupt decrease in calcitonin production. Furthermore, it is probable that components of the system maintaining calcium homeostasis vary depending on the duration of weightless and functional activity of the related regulatory systems. Author

N91-26690# Joint Publications Research Service, Arlington, VA.
COMPUTER TOMOGRAPHY MEASUREMENT OF VERTEBRAL BONES AND MUSCLES AFTER EXTENDED MANNED SPACE FLIGHTS Abstract Only

V. S. OGANOV, K. KANN, A. S. RAKHMANOV, and S. K. TERNOVOY *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 18 Apr. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya and Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 20-21

Avail: NTIS HC/MF A05

Computer tomography was employed to measure the mineral density of lumbar vertebrae spongy tissue and lumbar muscle mineral volume and density in four cosmonauts 1 to 3 months

prior to and 20 to 27 days following extended space flights (5 and 7 months). The results demonstrated a 7.8 percent decrease in calcium density in the posterior vertebral bodies and a 4.4 percent decrease in spinal muscle volume. Studies on volunteers on earth demonstrated a decrease in mineral density in only 10 percent of the subjects. The lack of changes in some of the subjects in both groups was attributed to the effectiveness of preventive measures and defense mechanisms of the muscles and bones. The results demonstrated that the changes in bones and muscles were not dependent on the length of flight and that physical exercise did not completely prevent unfavorable changes. These data are of interest in assessing the risk of developing osteoporosis and the potential the skeleton has of losing its strength in conditions of weightlessness. Suggestions are also made for further studies on bone metabolism during space flights. Author

N91-26691# Joint Publications Research Service, Arlington, VA.
FUNCTIONAL ACTIVITY OF HYPOPHYSEAL-THYROID SYSTEM DURING 370-DAY ANTIORTHOSTATIC HYPOKINESIA Abstract Only

YE. N. KABITSKIY *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1-2 18 Apr. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya and Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 28-30

Avail: NTIS HC/MF A05

Biochemical investigations of the hypophyseal-thyroid system were conducted on 10 healthy male volunteers at -5 degrees antiorthostatic hypokinesia. The principal means of preventing tissue degeneration was physical exercise while lying down. Group A began exercising on day 20 of the experiment, while group B began 100 days later. The 11 blood samples taken throughout the experiment were used to calculate the concentrations of thyrotropic hormone of the adenohypophysis, free thyroxine (FT sub 4) bound with thyroxin (T sub 4), and triiodothyronine (T sub 3). Radioimmunologic assay data detected no change in (T sub 4) concentrations and only a partial decrease in thyrotropic hormone. The data on (FT sub 4) suggest that inhibitory dissociation of the protein-hormone bond occurs during antiorthostatic hypokinesia. The results demonstrated that the decreased concentrations of T3 observed during antiorthostatic hypokinesia may reflect a decrease in plastic metabolism. The data also indicate that depression of (T sub 3) and (F sub 4) levels is due to enhance rates of utilization of these hormones by tissues in connection with increased motor activity and anaerobic processes. These findings suggest that exercise in conjunction with antiorthostatic hypokinesia decreases the role of the humoral factor in activation of the thyroid by the adenohypophysis. This leads to a slight decrease in thyroid activity which is manifest as a decrease in (FT sub 4) and (T sub 3) concentrations in the blood. Furthermore, these findings also demonstrated that exercise had no substantial effect on the functional activity of the hypophysis and thyroid. Author

N91-26692# Joint Publications Research Service, Arlington, VA.
CHANGES IN RHEOLOGIC INDICES OF BLOOD AND HEMODYNAMICS DURING 14-DAY ANTIORTHOSTATIC HYPOKINESIA Abstract Only

A. P. IVANOV, I. B. GONCHAROV, and L. G. REPENKOVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2 18 Apr. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya and Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 30-32

Avail: NTIS HC/MF A05

Rheologic indices of the blood and hemodynamics were compared in nine essentially healthy men aged 25 - 42 years during various stages of 14-day antiorthostatic hypokinesia at -8 degrees. Blood was drawn from the cubital vein on days 3, 7, and 14 of antiorthostatic hypokinesia and exhibited a 124.4 percent increase in Cassion blood viscosity, a 25.9 percent decrease in stroke volume, a 25.5 percent decrease in minute circulating volume, and a 23.6 percent increase in total peripheral resistance. These data suggest that there is a close relationship between

central hemodynamic and rheologic parameter indices in antiorthostatic hypokinesia. The negative correlation relationship between total peripheral resistance and the dynamic viscosity of the blood is apparently associated with an increase in total peripheral resistance and blood viscosity as a result of slower circulation. Stases develop in the venous and capillary sections of the peripheral vascular system, and some of the formed elements of the blood are excluded from active circulation. All of these effects result in the additional opening of arteriovenous anastomoses in order to support adequate stroke and minute volumes. It is hoped that these studies will contribute to an understanding of how to control high blood viscosity, one of the risk factors of developing ischemic heart disease. Author

N91-26694# Joint Publications Research Service, Arlington, VA. **BIOCHEMICAL ASPECTS OF HUMAN ADAPTATION TO COMBINED EFFECT OF ANTIORTHOSTASIS, DECREASED BAROMETRIC PRESSURE, AND INCREASED OXYGEN CONTENT Abstract Only**

T. N. BALANDINA, YE. I. NIKITIN, YE. A. KOVALENKO, and V. P. SAVINA. *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2-3 18 Apr. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 56-57
Avail: NTIS HC/MF A05

The effects of relatively slight hyperoxia (pO₂ of 300 mm Hg) for 5 h and -8 degrees antiorthostasis were assessed on seven men aged 25 - 35 years in an altitude chamber set at 7,100 m. The test subjects were also exposed to thermal (37 C) and physical stress (600 kg/m/min) for 5 min in the first, third, and fifth hours in the chamber and for 25 min also during the fifth hour. Venous blood was drawn before and after each trial for purposes of calculating malonic dialdehyde and self-induced lipid peroxidation levels. The results demonstrated that during the five-hour antiorthostatic period without exertion, erythrocytic catalase activity activated the protection antioxidant system, while the formation of self-induced lipid peroxidation with exertion, the opposite was observed, i.e., normalization of metabolism. The results of the biochemical investigations as a whole suggest that in 5 h of antiorthostasis at -8 degrees without exertion and with a pO₂ of 300 mm Hg there is an aspect of stressing erythrocyte metabolism and compensating reactions. It was established that physical exercise in both regimens stabilizes the metabolic equilibrium that was distributed in the cells, which is reflected in retention of the structural integrity of the erythrocyte membrane. In addition, considering the degree of expression of the changes observed and signs of reparations of the erythrocyte membrane, these manifestations are judged to be functionally somewhat reversible, structural changes. Author

N91-26696# Joint Publications Research Service, Arlington, VA. **JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

20 May 1991 27 p Transl. into ENGLISH of various Russian articles
(JPRS-ULS-91-011) Avail: NTIS HC/MF A03

Topics addressed include: aerospace medicine; biochemistry; environment; genetics; immunology; laser bioeffects; and clinical medicine.

N91-26697# Joint Publications Research Service, Arlington, VA. **VISUAL ACCOMMODATION IN COSMONAUTS Abstract Only**

I. A. SKIBA, V. K. TKACHENKO, and I. A. PLYASOVA-BAKUNINA. *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 14-16
Avail: NTIS HC/MF A03

Ophthalmologographic studies were conducted on three cosmonauts before, during, and after space flight to assess visual accommodation. The results revealed various degrees of deterioration in visual accommodation due to peripheral and central

fatigue as a result of overload on the visual analyzer. The findings point to the need for improving illumination aboard spacecraft and mitigation of close-up work to the extent possible. Additional measures will have to include prophylactic measures as well as to render the visual system more tolerant of prolonged stress. Author

N91-26698# Joint Publications Research Service, Arlington, VA. **VESTIBULAR REACTIONS AND INTERSENSORY INTERACTIONS IN WEIGHTLESSNESS: RESULTS OF OPTOKINEZ EXPERIMENT Abstract Only**

L. N. KORNILOVA, G. BODO, I. K. TARASOV, and V. N. ALEKSEYEV. *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 16-20
Avail: NTIS HC/MF A03

The responsiveness of opto- and vestibulooculomotor systems was analyzed in the course of Optokinez experiment performed in 1984 on cosmonauts involved in a joint 7-day Soviet-Indian space flight, and during a 237-day mission aboard Salyut-7 space station. Although the subjects did not complain of motion sickness, the resultant data demonstrated that weightlessness enhanced spontaneous eye movements (including nystagmus in one crew member), and led to deterioration of saccadic tracking, diminished the amplitude of saccadic movements and incidence of corrective microsaccades in fixation events. Compensatory counter-movement of the eyes during sidewise head movements was diminished while wearing dark glasses, but did not disappear and was accompanied by low amplitude nystagmus. The findings were interpreted as a reflection of enhanced dynamic excitability of visual and vestibular afferent pathways and diminished static vestibular excitability. The diminished sensory response thresholds were attributed to the interplay of diminished proprioceptive inflow and abatement of corticofugal outflow, a combination which attenuates inhibition of subcortical formations by cortical regions. A more comprehensive assessment of the intersensory interactions would need to consider the effects of weightlessness on fluid displacement in the vestibular apparatus and its effects on brain function. Author

N91-26699# Joint Publications Research Service, Arlington, VA. **EFFECT OF EXCESS RESPIRATORY RESISTANCE ON PHYSICAL PERFORMANCE AND CARDIORESPIRATORY FUNCTION Abstract Only**

A. S. BARER, I. S. BRESLAV, G. G. ISAYEV, and YE. A. SOKOL. *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 20-22
Avail: NTIS HC/MF A03

An analysis was conducted on the effects of increased respiratory resistance on physical performance and cardiorespiratory function. The study involved 13 healthy males, 22 to 47 years old, subjected to an increasing physical load on an exercise bicycle at a rate of 30 W every 3 min in conjunction with respiratory (inhalatory and expiratory) resistance of 12, 16, 20 or 40 cm H₂O/L x sec. The results showed that the maximum physical load tolerated under these conditions was inversely related to the square root of the increase in respiratory resistance multiplied by 1.5. Author

N91-26701# Joint Publications Research Service, Arlington, VA. **PHYSICAL AND PSYCHOGENIC SEQUELAE OF IMPACT ACCELERATION ON TRACKING PERFORMANCE OF OPERATORS Abstract Only**

A. K. YEPISHKIN. *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 28-30
Avail: NTIS HC/MF A03

An analysis was conducted on the psychogenic and physical factors of impact acceleration (10 to 16 Gs) as they affect tracking performance. The study was performed on nine healthy males, 18

to 20 years of age, subjected to six impact acceleration events in the head-pelvis projection (1 to 2 experiments/day at 2 to 4 day intervals). Tracking and heart rate were monitored before and after the impact. The results demonstrated that impact acceleration increased both the error rate and the response time to changes in signal frequency. In addition, psychogenic factors, as deduced from the heart rate, were of major importance in determining the error rate. Accordingly, the mental stress represented by anticipation of the impact acted synergistically with physical stress on sensorimotor performance. Nevertheless, with repetition the degree of sensorimotor disturbances abated after successive impacts, and tracking performance improved. Consequently, emotional factors were shown to have positive and negative components, suggesting that a proper training and preparation may be employed in averting deterioration of sensorimotor performance due to physical stress. Author

N91-26702# Joint Publications Research Service, Arlington, VA. REACTION OF HUMAN SKELETAL MUSCLE FIBERS TO 370 DAY ANTIORTHOSTATIC HYPOKINESIA COMBINED WITH PHYSICAL EXERTION Abstract Only

S. L. KUZNETSOV and V. V. STEPANOV *In its JPRS Report: Science and Technology. USSR: Life Sciences p 2 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 34-38*

Avail: NTIS HC/MF A03

Ten healthy males, 27 to 44 years old, were subjected to a 370 antiorthostatic (-8 degrees head inclination) hypokinesia to assess the effects of various schedules of physical activity on skeletal muscles at the ultrastructural level. Examination of biopsies obtained from the gastrocnemius muscle showed that prolonged antiorthostatic hypokinesia led to astrophobic changes and attenuation of metabolic processes. Regular periods of exercise had beneficial effects on averting adverse changes, with the benefits showing a direct correlation with intensity and early institution. The exercise program was far less effective when delayed to the 120th day of bedrest. In general, examination of the myofibrils demonstrated that exercise-promoted recovery was favored by retention of normal structural relationships between actin and myosin. Author

N91-26705# Joint Publications Research Service, Arlington, VA. DIAGNOSTIC UTILITY OF CONTINUOUS NONINVASIVE BLOOD PRESSURE MONITORING (PENAZ METHOD) IN GRAVITY-INDUCED BLOOD REDISTRIBUTION Abstract Only

V. YU. LUKYANYUK, A. R. KOTOVSKAYA, I. F. VIL-VILYAMS, L. NOVAK, YA. PENYAZ, V. M. MIKHAYLOV, YU. D. POMETOV, V. S. GEORGIYEVSKIY, G. F. NIKOLASHIN, and V. I. KUZINA *In its JPRS Report: Science and Technology. USSR: Life Sciences p 3-4 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 30-34*

Avail: NTIS HC/MF A03

The Penaz method of continuous, noninvasive monitoring of arterial blood pressure (BP) was assessed for its diagnostic utility vis-a-vis syncope resulting from redistribution of blood volume. The method is based on measuring BP in a finger, with the palm maintained at heart level. The study was conducted on 25 to 45 year old subjects after 240 days of simulated weightlessness (antiorthostasis at -8 degrees), and involved passive antiorthostasis at 75 degrees for 20 min or negative pressure suits (-25 to -60 mm Hg) on the lower half of the trunk for 25 min. The results demonstrated that incipient syncope was preceded by onset of second and third order BP waves on servotonograms. In addition, appearance of these wave patterns was accompanied by a sharp fall in pulse pressure to critical levels due to reduction in the stroke volume and diminished venous return. The Penaz method was demonstrated to provide an earlier indication of such events than the use of discrete methods for BP monitoring. Author

N91-26706# Joint Publications Research Service, Arlington, VA. STATE AND FORMS OF ADAPTATION OF VESTIBULAR FUNCTION AFTER SPACE FLIGHTS Abstract Only

L. N. KORNILOVA and I. K. TARASOV *In its JPRS Report: Science and Technology. USSR: Life Sciences p 4 20 May 1991 Transl. into ENGLISH from Vestnik Otorinolaringologii (Moscow, USSR), no. 6, Nov. - Dec. 1990 p 22-27*

Avail: NTIS HC/MF A03

Electrooculographic studies revealed the state of vestibular function and the sensory systems interacting with it 30 days before a flight and on 0-1, 2-3, 5-6, 8-10 and, sometimes, 14-15 and 75 days after the flight. The study assessed the characteristics of spontaneous nystagmus and positional nystagmus after passive (on a tilt-table) changes of body position and during vestibular, oculovestibular, proprioceptive stimulation and during cerebellar tests in the sitting position, clinostatic, antiorthostatic and orthostatic positions. All cosmonauts (except some crew commanders) displayed signs of vestibular dysfunction with differing degrees of pronouncement of illusory, motor and autonomic reactions. The dysfunction was transitory and reflected normally proceeding adaptation to a new sensory environment. The procedure employed permitted differentiation of mechanisms of vestibular dysfunction revealed after the flight. Some cosmonauts showed nystagmoid responses only in tilt-table tests while others displayed them as a result of additional proprioceptive and oculovestibular stimulation and in cerebellar coordination tests. The study made it possible to differentiate pathogenesis of vestibular dysfunctions and to study ways and forms of adaptation of vestibular function to gravitation. Author

N91-26707# Joint Publications Research Service, Arlington, VA. COMBINED EFFECT OF NOISE AND VIBRATION ON CELLS OF AUDITORY AND VESTIBULAR APPARATUS Abstract Only

A. S. NEKHOROSHEV and A. N. IGNATYUK *In its JPRS Report: Science and Technology. USSR: Life Sciences p 4 20 May 1991 Transl. into ENGLISH from Vestnik Otorinolaringologii (Moscow, USSR), no. 6, Nov. - Dec. 1990 p 27-30*

Avail: NTIS HC/MF A03

A study of the effect of whole-body vertical vibrational acceleration with a peak at mean geometric frequencies of 31.5 and 60 Hz octave bands, equalling 66 and 76 dB respectively and constant wide-band noise with sound pressure of 85 DBa and 90 dBLin on the membranous labyrinth of the cochlea and receptor cells of the semicircular canals was described and discussed. Male guinea pigs (90) underwent the effect of these factors for 1, 5, 10, 15, 20, 60, and 90 days for 3 hours daily. After the experiments, the guinea pigs were decapitated and histological sections were studied by electron microscopy. The combined effect of the noise and vibration injured the receptor cells of the auditory analyzer and affected the spiral organ especially. Changes observed appeared as rhythmic functional pulsation of the nuclei with deformation of the cellular nuclei in some cases. The phenomena increased with an increase of the duration of effect and embraced almost all sensitive cells of the spiral organ. Electron microscopy data showed changes not only of the nuclei of the injured sensitive cells but also of the endoplasmic reticulum of the cytoplasm, especially with changes of the mitochondria and simultaneous changes of the endoplasmic reticulum membranes. These changes were reversibly for up to 20 days. After longer exposure (60 and 90 days) changes in hair cells of the spiral organ involving deformation and disintegration of chromatin, mitochondria, and endoplasmic reticulum membranes were irreversible and caused decay of the injured cells. Author

N91-26708# California Univ., Los Angeles. PEPTIDE TRANSPORT THROUGH THE BLOOD-BRAIN BARRIER Final Report, 1 Jul. 1987 - 31 Dec. 1990

WILLIAM M. PARTRIDGE 15 Jan. 1991 15 p
(Contract DAMD17-87-C-7137; DA PROJ. 3M1-61102-BS-12)
(AD-A233753) Avail: NTIS HC/MF A03 CSCL 06/1

Most neuropeptides are incapable of entering the brain from blood owing to the presence of unique anatomical structures in the brain capillary wall, which makes up the blood-brain barrier

(BBB). Such neuropeptides could be introduced into the bloodstream by intranasal insufflation and, thus, could have powerful medicinal properties (e.g., Beta-endorphin for the treatment of pain, vasopressin analogues for treatment of memory, ACTH analogues for treatment of post-traumatic epilepsy), should these peptides be capable of traversing the BBB. One such strategy for peptide delivery through the BBB is the development of chimeric peptides, which is the basis of the present contract. The production of chimeric peptides involves the covalent coupling of a nontransportable peptide (e.g., Beta-endorphin, vasopressin) to a transportable vector peptide (e.g., insulin, transferrin, cationized albumin, histone). The transportable peptide is capable of penetrating the BBB via receptor-mediated or absorptive-mediated transcytosis. Therefore, the introduction of chimeric peptides allows the nontransportable peptide to traverse the BBB via a physiologic piggy back mechanism. GRA

N91-26709# Naval Medical Research Inst., Bethesda, MD.
YOUNG AND OLDER OBSERVERS SHOW SIMILAR PERCEIVED CONTRAST FUNCTIONS FOR ISOLUMINANT STIMULI Technical Report, Oct. 1984 - Sep. 1990
 KARL F. VANORDEN and JOSEPH F. STURR Jan. 1991 28 p
 (Contract DA PROJ. 3M4-63764-B-995)
 (AD-A233766; NMRI-91-09) Avail: NTIS HC/MF A03 CSCL 06/4

Previous research from our laboratory has demonstrated an age-related difference in the perceived brightness of brief, low intensity flashes of light. The purpose of this experiment was to determine if the age-related brightness differences would generalize to isoluminant conditions. Thus, the effect of age on visual system contrast gain was examined by use of sinusoidal grating stimuli with the method of contrast estimation. Ten young and 10 older males (mean ages 20 and 64.5 yrs) viewed counterphase flickered gratings of 0.6 and 6.0 c/deg ranging in contrast from 1 to 50 percent. The resulting linear functions of log perceived contrast as a function of log stimulus contrast showed no age-related differences and suggest equivalent contrast gain with age. These results, placed within the context of previous research, suggest that the largest age-related differences in visual performance are found when subjects must perform a detection/recognition task that is embedded in a flashing background. GRA

N91-26710# Naval Medical Research Inst., Bethesda, MD.
COLDEX-86: PHYSICAL WORK CAPACITY DURING PROLONGED COLD WATER IMMERSION AT 6.1 MSW Technical Report, May - Sep. 1986
 T. J. DOUBT and D. J. SMITH Dec. 1990 33 p
 (AD-A233767; NMRI-90-135) Avail: NTIS HC/MF A03 CSCL 06/5

Response to submaximal leg exercise was quantified in 16 U.S. Navy divers who performed whole body immersions in 5 C water for periods of up to 6 h. Divers wore passive dry suit thermal protection. Immersions were done during the course of 5-day air saturation dives at a depth of 6.1 msw (20 fsw). Each diver participated in 2 saturation dives. Two immersions were conducted per dive, one beginning at 1000 h, and one beginning at 2200 h; there was a period of 54 h between immersions. During the second saturation dive the presentation of immersion times was reversed. The subjects performed leg exercise on a cycle ergometer for 3 min each at workloads of 50, 70, and 90 watts (W). Heart rate (HR) and O₂ consumption (VO₂) were measured during the last minute at each workload. The study was divided into 2 series. GRA

N91-26711# Naval Medical Research Inst., Bethesda, MD.
COLDEX-86: FLUID AND ELECTROLYTE CHANGES DURING PROLONGED COLD WATER IMMERSION Technical Report, May 1986 - Aug. 1987
 P. A. DEUSTER, D. J. SMITH, B. L. SMOAK, L. C. MONTGOMERY, and T. J. DOUBT Dec. 1990 56 p
 (AD-A233768; NMRI-90-133) Avail: NTIS HC/MF A04 CSCL 07/4

Dehydration and hypothermia are major inhibitors of diver performance in cold water. To characterize the dehydration that accompanies cold water immersion, 16 U.S. Navy divers participated in two 5-day air saturation dives (ASD) at a depth of 6.1 meters sea water (msw). During each ASD, divers completed two immersions in 5 C water: one began at 1000 h (AM) and the other at 2200 h (PM); a period of 54 h separated the immersions. Divers wore dry suits for thermal protection, and full face masks during immersions that lasted 3-6 h. All divers consumed identical diets. Blood samples were collected before and after each immersion, and urine was collected for 24 h in three separate periods on immersion days: for 12 h prior to immersion, during immersion, and after immersion until the end of the 24 h period. Plasma volume decreased significantly by approximately 17 percent during both AM and PM immersions. GRA

N91-26712# Rockefeller Univ., New York, NY.
CARBOXYALKYLATED HEMOGLOBIN AS A POTENTIAL BLOOD SUBSTITUTE Annual Report, 1 Sep. 1989 - 31 Aug. 1990

JAMES M. MANNING 25 Sep. 1990 29 p
 (Contract DAMD17-88-C-81699)
 (AD-A233822) Avail: NTIS HC/MF A03 CSCL 06/1

A new crosslinking agent for hemoglobin, a diisothiocyanobenzene sulfonate derivative, has been explored this past year. The yield of crosslinked products (5 to 6) is high (about 75 percent) and all the crosslinking is within the tetramer to produce 64,000 molecular weight species, which do not dissociate. The major crosslinked component was purified and the position of the crosslink was established by a combination of amino acid analysis, protein sequencing and mass spectral analysis. Its single crosslink was found to be between the NH₂-terminal residues of the alpha-chains. In a collaborative effort, the material was supplied to the Letterman Army Institute of Research. That investigation found that the plasma retention time of this species in rats was prolonged almost 4-fold to an average of 3.1 hrs, compared to 0.7 hrs for uncrosslinked, carboxymethylated hemoglobin. Therefore, the plasma retention time is related to the crosslinking hemoglobin but not to its oxygen affinity. GRA

N91-26713# Louisiana State Univ., New Orleans.
METABOLIC CHANGES AND HEMODYNAMIC DYSFUNCTION FOLLOWING HYPOTHERMIC SHOCK Status Report, 1 Oct. 1990 - 31 Jan. 1991

HARVEY I. MILLER 1 Oct. 1990 10 p
 (Contract N00014-89-J-3124)
 (AD-A233942) Avail: NTIS HC/MF A02 CSCL 06/10

Shock, which is the result of acute and severe accidental hypothermia, can produce subtle injuries to several organs. The manifestations of these injuries are difficult to observe because of compensatory mechanisms; however, they can persist many hours past the return to normal body temperature. The severity of these organ dysfunctions is not always great but coupled with other changes can jeopardize the survival of the victim. The purpose of these investigations is to uncover the mechanisms which produce the dysfunctions and determine proper therapeutic procedures to stop and reverse this pathological process. One of the therapeutic interventions which is being studied is fluid resuscitation, which is applied during the short rewarm period. We have shown that following hypothermia and rewarm a cardiac dysfunction persists over 48 hours. This dysfunction is hidden in the whole intact animal because of the cardiovascular compensatory mechanism. GRA

N91-26714# City of Hope Medical Center, Duarte, CA.
EVALUATION OF LIPOSOME-ENCAPSULATED HEMOGLOBIN/LR16 FORMULATION AS A POTENTIAL BLOOD SUBSTITUTE

THOMAS G. BURKE 15 Mar. 1991 6 p
 (Contract N00014-90-J-1648)
 (AD-A233973; REPT-1) Avail: NTIS HC/MF A02 CSCL 06/5

During the last four months of our project entitled, Evaluation of Liposome-Encapsulated Hemoglobin/LR16 Formulation as a Potential Blood Substitute, efforts have been made in the following

four areas: (1) the resynthesis of LR16; (2) physical characterization of LEH/LR16 formulations; (3) design and development of membrane-impermeable LR16 analogues; and (4) preparations for small animal testing of surrogate blood preparations. The work completed in each of these areas is outlined below. GRA

N91-26715# Naval Medical Research Inst., Bethesda, MD.
COLDEX-86: SUMMARY OF THE EXPERIMENTAL PROTOCOL AND GENERAL RESULTS Technical Report, May - Sep. 1986
T. J. DOUBT, R. P. WEINBERG, D. J. SMITH, P. A. DEUSTER, and A. J. DUTKA Dec. 1990 28 p
(AD-A234031; NMRI-90-132) Avail: NTIS HC/MF A03 CSCL 13/10

Aspects of temperature regulation, exercise capacity, and passive rewarming were evaluated during planned 6 h immersions in 5 deg C (41 deg F) water. A total of 16 divers (12 First Class divers, 4 SEALs) performed 63 manned immersions. Each diver wore a full face mask (modified AGA mask) and breathed compressed air at 6.1 msw (20 fsw). A butyl-nylon dry suit with M-600 Thinsulate thermal protection undergarments was worn. Hands were protected with a M-200 Thinsulate glove worn beneath a water tight latex glove; a neoprene outer gauntlet mitt was worn over the latex glove. The divers completed two 5 day air saturation dives at 6.1 msw, with a week separating dives. Each diver made two immersions during the dives, with 54 hours between immersions. One immersion began at 1000 hours (AM dive) and the other at 2200 hours (PM dive). The order of presentation of AM and PM dives was varied among the subjects. During one saturation dive the divers were fed a high carbohydrate diet, while during the second dive the divers were fed a standard American mixed diet. Both diets provided 3000 kcal per day. Urine and venous blood samples were obtained before and after each immersion. Urine was also collected during the immersion. Body temperatures, regional heat fluxes, oxygen consumption, and EKG recordings were obtained throughout the immersion. GRA

N91-26716# Illinois Univ., Chicago.
ATTENTION SPAN, ANXIETY, AND BENZODIAZEPINE RECEPTORS Final Report, 1 Jul. 1987 - 30 Dec. 1990
THADDEUS J. MARCZYNSKI 26 Feb. 1991 60 p
(Contract AF-AFOSR-0364-87; AF PROJ. 2312)
(AD-A234549; AFOSR-91-0283TR) Avail: NTIS HC/MF A04 CSCL 15/6

The specific (H-3) flunitrazepam binding to neocortical and hippocampal membranes was measured following a two week treatment of rats with the benzodiazepine receptor antagonist flumazenil (FL; Ro 15-1788; 2.7 or 4 mg/kg/day in drinking water). The binding sites showed a gradually increasing density, which remained elevated for up to 24 and 72 hours after drug withdrawal. The dissociation constants (Kd) for the ligand remained largely unchanged. Most importantly, a strong coupling between the GABA and the benzodiazepine recognition sites was found in the cortex but not in the hippocampus, as measured by reduction in GABA enhanced (H-3) flunitrazepam bindings to neuronal membranes from FL- treated animals killed 72 hours after drug withdrawal. The behavioral correlates of chronic exposure of adult rats to FL are presented. GRA

N91-26717# Naval Health Research Center, San Diego, CA.
SMOKING, EXERCISE, AND PHYSICAL FITNESS Interim Report
TERRY L. CONWAY and TERRY A. CRONAN 30 Nov. 1990 22 p
(AD-A234658; NHRC-90-43) Avail: NTIS HC/MF A03 CSCL 06/5

Research on smoking and physical activity provides strong evidence of smoking's negative impact and physical activity's positive impact on long-term health. However, evidence is lacking on the association between smoking and spontaneous exercise activity and the independent effects of these factors on physical fitness. These factors were studied in 3,045 Navy personnel. Smoking was clearly associated with lower exercise levels and lower physical endurance (cardiorespiratory and muscular) even

after controlling for exercise. Smoking was not related to overall body strength (lean body mass) nor percent body fat after controlling for exercise. These findings suggests that both the direct and indirect links among smoking, exercise, and physical fitness should be explored in model's examining health. GRA

N91-26718# Naval Health Research Center, San Diego, CA.
METHYLPHENIDATE AND PEMOLINE: EFFECTS ON SLEEPINESS AND MOOD DURING SLEEP DEPRIVATION Interim Report
4 Mar. 1991 16 p
(AD-A234659; NHRC-90-41) Avail: NTIS HC/MF A03 CSCL 06/10

Thirty-six male subjects (mean age = 20.94) participated in a study of the effects of methylphenidate (10 mg every 6 hours; 8 doses) or pemoline (37.5 mg every 12 hours; 4 doses) in maintaining alertness during 64 hours of sleep deprivation. Subjective sleepiness was measured by a Visual Analog Scale (VAS), objective sleepiness by the number of lapses (intertap interval 3 seconds) on a 10 minute tapping task, and mood by the Profile of Mood States (POMS). Results indicate that 37.5 mg pemoline administered every 12 hours significantly reduced both subjective and objective sleepiness in sleep deprived subjects. Primarily during the circadian troughs periods which occur during the early morning and early afternoon hours, but has little effect on self ratings of mood; while 10 mg of methylphenidate administered every 6 hours has no significant effect on these measures. GRA

N91-26719# Chicago Univ., IL. Dept. of Medicine.
DEVELOPMENT OF ADVANCED METHODS BASED ON STABLE ISOTOPE TECHNOLOGY FOR STUDIES OF EXERCISE IN HEAT Final Report, 28 Sep. 1987 - 27 Sep. 1990
ORTEZA JANGHORBANI 20 Oct. 1990 30 p
(Contract DAMD17-87-C-7235; DA PROJ. 3M1-61102-BS-15)
(AD-A234670) Avail: NTIS HC/MF A03 CSCL 18/2

Stable isotope methods were developed for studies of dynamics of turnover of total body water, extracellular and intracellular fluid volume, total body potassium and magnesium. The methods were based on the new technique of inductively coupled plasma mass spectrometry. These methods were then applied for studies of distribution of body water in micro swine, studies of total body potassium and magnesium in the rat, and study of turnover of endogenous body potassium and magnesium in the mouse. It was shown that these methods permit detailed investigation of dynamics of electrolyte turnover. Compartmentation of body magnesium was studied under the conditions of dietary magnesium restriction. It was found that important shifts occurred in terms of exchangeability of organ magnesium under these conditions. GRA

N91-26720# California Univ., San Francisco.
THE EFFECT OF CATECHOLAMINES ON ARTERIAL BLOOD PRESSURE AND HEART RATE Final Report
MARY F. DALLMAN and DANIEL N. DARLINGTON 1 Oct. 1990 33 p
(Contract N00014-88-K-0059)
(AD-A234755) Avail: NTIS HC/MF A03 CSCL 06/5

There is an abundant amount of evidence suggesting that catecholamines administered centrally can regulate adrenocorticotropin (ACTH) and vasopressin (AVP) release. Because there is a heavy catecholaminergic projection from the brainstem innervating the para-ventricular nucleus (PVN) of the hypothalamus, the nuclear region that regulates AVP and ACTH release from the pituitary it has been suggested that catecholaminergic regulation of ACTH and AVP may occur directly at this site. Also, these catecholaminergic cell groups are located in regions involved in the regulation of baroreflexes and the regulation of arterial blood pressure and heart rate during hemorrhage. GRA

N91-26721# Federal Aviation Administration, Washington, DC.
Office of Aviation Medicine.
UTILIZATION OF EMERGENCY MEDICAL KITS BY AIR CARRIERS

J. R. HORDINSKY and M. H. GEORGE Mar. 1991 7 p
(AD-A234784; DOT/FAA/AM-91/2) Avail: NTIS HC/MF A02
CSCL 06/5

The Department of Transportation Emergency Medical Equipment Requirements Rule of January 9, 1986, mandated a period of 24 months (August 1986-July 1988) during which all air carriers flying under Federal Aviation Regulation, Part 121, would monitor medical emergencies and use of the prescribed medical kits. The reporting airlines were to provide descriptions of how the medical kits were used, by whom, and the outcome of the medical emergency. During the two year monitoring period, a total of 2,322 reports of medical emergencies were documented; these included 33 inflight deaths, with only one of these representing a crew member (secondary to aircraft structural failure and resultant physical trauma). In the 2,293 actual uses of the medical kit, a physician was the provider in over 85% of the cases. The most common presenting symptom was pain, with unconsciousness, impaired breathing, nausea and/or vomiting, and various myocardial diagnose the most common presenting sign (in descending order of frequency). High frequency recurrent complaints about kit adequacy were not noted during the two year monitoring period; there were scattered references about the poor technical quality of the most frequently employed equipment; the medical kit content might selectively be expanded to include analgesics, antiarrhythmics, antiemetics, and bronchodilators. GRA

N91-26722# Army Natick Labs., MA.
PHYSIOLOGICAL AND PERCEPTUAL RESPONSES TO LOAD CARRYING IN FEMALE SUBJECTS USING INTERNAL AND EXTERNAL FRAME BACKPACKS Final Report, Jan. - Oct. 1990

JOHN KIRK and DONALD A. SCHNEIDER Apr. 1991 82 p
(AD-A234941; NATICK/TR-91/023) Avail: NTIS HC/MF A05
CSCL 06/10

Eleven female subjects (ages 18-33) walked on a motor driven treadmill at 3.2 mph for one hour carrying 33 percent of their body weight. The grade of the treadmill alternated every 15 minutes from 0 to 3 percent. Each subject carried an internal frame backpack for one trial and an external frame backpack for another trial on a separate day. The variables measured during the two load-carrying experiments included oxygen consumption (VO₂), heart rate (HR), respiratory exchange ratio (R), minute ventilation (VE), and the ratings of perceived exertion for the chest (RPE-chest), shoulders (RPE-shoulders), and legs (RPE-legs). There were no statistically significant differences found between the two packs for any of the metabolic, cardiorespiratory, or perceptual variables measured. The grade of the treadmill had a significant effect on VO₂, R, VE, and HR regardless of the type of pack carried. Minute ventilation was the only physiological response to load carrying that was significantly influenced by exercise time. The values for RPE-chest, RPE-shoulders, and RPE-legs were significantly increased by exercise time and treadmill slope, regardless of the type of pack frame carried. It was concluded that when a load is carried on the back, differences in backpack frame designs are not great enough to produce significant differences in the energy cost or perception of carrying a moderately heavy load. GRA

N91-26723# Johns Hopkins Univ., Baltimore, MD.
STUDIES OF MUTANT HEMOGLOBINS TO DEFINE TYPES OF MODIFICATIONS USEFUL IN THE DESIGN OF BLOOD SUBSTITUTES Final Report, 16 Jun. 1988 - 31 Dec. 1989

GARY K. ACKERS 25 Mar. 1991 140 p
(Contract DAMD17-88-C-8014; DA PROJ. 3M1-62772-A-874)
(AD-A234997) Avail: NTIS HC/MF A07 CSCL 06/5

Studies were carried out with mutant and chemically-modified human hemoglobins to determine structure-function characteristics that may be useful in the design of a blood substitute (i.e., by eventual combination of cross-linking and amino acid residue modifications). The results from 57 hemoglobins provide an unprecedented data base regarding the responses of oxygen binding cooperativity to single site modifications. These data define the structural location of and the nature of the driving forces for

cooperativity. They provide the first systematic assessment of the relationship between structural location and chemical nature of the modified residue site in altering cooperativity. The results provide an optimistic initial baseline from which to anticipate the eventual rational design of hemoglobins with desired functional and regulatory properties. GRA

N91-26724# Texas Univ., Galveston. Medical Branch.
PHARMACOLOGICAL SPARING OF PROTEIN IN BURN INJURY Final Annual Report, 15 Mar. 1987 - 14 Mar. 1990
ROBERT R. WOLFE 1 Nov. 1990 101 p
(Contract DAMD17-87-C-7030; DA PROJ. 3S1-62772-A-874)
(AD-A235026) Avail: NTIS HC/MF A06 CSCL 06/5

The primary goal of the research studies sponsored by this project was to assess the effect of sepsis and/or severe burn injury on the normal anabolic effect of insulin on protein metabolism. All studies were performed in human patients and normal volunteers using stable isotopic tracers and mass spectrometry analysis to quantify various metabolic factors. The first protocol involved the assessment of the effect of seven days bedrest in normal volunteers on glucose and protein responsiveness to insulin. The results following bedrest served as control values for subsequent studies in patients. The most striking aspect of these studies was the modest effect of bedrest, per se, as compared to the responses observed in bedrested patients following severe burn injury or during sepsis. Severe burn injury without systemic sepsis induced only a moderate resistance to the action of insulin on glucose uptake and potassium uptake, when compared to the bedrested controls. Sepsis halved the normal stimulatory effect of insulin on glucose uptake. Potassium uptake remained normally responsive to insulin in septic patients. Further studies are required to delineate a specific dose-response curve between insulin concentration, suppression of protein breakdown, and fat balance in the liver in order to formulate optimal treatment protocols incorporating the administration of insulin as an anabolic agent. GRA

N91-26725# Navy Personnel Research and Development Center, San Diego, CA.
THE P300 COMPONENT OF THE AUDITORY EVENT-RELATED POTENTIAL: INTERLABORATORY CONSISTENCY AND TEST-RETEST RELIABILITY Final Report, Oct. 1988 - Sep. 1989

LEONARD J. TREJO, MARK INLOW, ROBERT R. STANNY, WILLIAM A. MOREY, and SCOTT MAKEIG Mar. 1991 47 p
(AD-A235114; NPRDC-TR-91-6) Avail: NTIS HC/MF A03
CSCL 06/4

The auditory evoked potential in a signal classification task using rare and frequent tones was measured by four independent laboratories, to assess the test-retest reliability and interlaboratory consistency of the P300 component. Across laboratories, 61 male subjects (three samples of military subjects, n=25, n=18, and n=8; one sample of college students, n=10), ranging between 18 and 49 years of age were tested. With few exceptions, all experimental and subject factors were controlled. At each of three electrode sites (Fz, Cz, Pz), peak amplitude, peak latency, and root-mean-square amplitude (RMS), of the P300 were computed for each subject in test and retest conditions. Statistical analyses of the data supported three strong inferences: (1) test-retest reliability and interlaboratory consistency of P300 measures is high for RMS amplitude, lower for peak amplitude, and lowest for peak latency; (2) recordings from site Pz provide higher reliability and consistency than sites Fz or Cz; and (3) the RMS amplitude of P300 is negatively correlated with reaction time to correctly classify rare tones. The data support the notion that (Event Related Potential) components, such as P300, can be reliably measured by different laboratories, with a test-retest correlation coefficient of 0.8 or higher. GRA

N91-26726# Texas A&M Univ., College Station.
PROTON ARC DOSES TO THE PRIMATE HEAD Final Report, 30 Nov. 1989 - 30 Sep. 1990
DENNIS D. LEAVITT Dec. 1990 21 p

(Contract F33615-87-D-0627)
(AD-A235134; USAFSAM-TP-90-24) Avail: NTIS HC/MF A03
CSCL 06/7

The radiation dose distributions to the primate head are calculated for 10, 32, 55, and 110 MeV protons incident in the primate. Rotation of the primate in the fields is simulated by summing a 360 degree arc in 1/2 degree increments. Representative anatomy is determined by computerized tomography scans of a primate head phantom. Dose-volume histograms are used to compare the dose to the brain for each of the four irradiation techniques. Surface dose and depth dose calculations are made to evaluate the dosimetric effects to the primate eye. Estimates are made of the effects of irradiation with the primate eyes open versus closed. A focusing effect is described to explain the localized high doses seen with 32 and 55 MeV proton exposures. Doses to the eye are calculated and tabulated by animal identification key for a series of irradiated primates. These calculations demonstrate significant departures from the dose predictions based on simple cylindrical phantoms, suggesting that careful review of the primate dosimetry must accompany any evaluation of radiation effects on these animals. GRA

N91-26727# School of Aerospace Medicine, Brooks AFB, TX.
ADMINISTRATIVE GUIDE FOR THE FLIGHT SURGEON AND THE AEROMEDICAL TECHNICIAN: PERFORMING MEDICAL EXAMINATIONS Final Report, Aug. - Oct. 1990
JOHN C. HAUSMANN, JR. Dec. 1990 63 p
(AD-A235178; USAFSAM-SR-90-5) Avail: NTIS HC/MF A04
CSCL 06/5

This handout consolidates information taught in the Aerospace Medicine Primary, Aerospace Medicine Specialist, and Advanced Medical Standards courses, as well as guidance presented in Air Force Regulations and Pamphlets. This information is used on a daily basis in the Flight Surgeon's Office and Physical Examinations and Standards Sections. It is now being presented in a single, consolidated reference source. GRA

N91-26728# Army Research Inst. of Environmental Medicine, Natick, MA.

LEVEL OF DIETARY FAT DOES NOT AFFECT FUEL OXIDATION OR ENDURANCE EXERCISE PERFORMANCE OF SOLDIERS Final Report

R. W. HOYT, T. E. JONES, M. S. ROSE, V. A. FORTE, JR., and M. J. DURKOT 15 Mar. 1991 84 p
(AD-A235194) Avail: NTIS HC/MF A05 CSCL 06/8

The objective was to determine whether additional dietary fat calories influenced the physiology or endurance exercise performance of physically active soldiers. Eight male soldiers (age 22 +/- 2 yrs, X +/- SEM) participated in two five-day test cycles while eating either a basal diet (2300 kcal; 40 percent fat calories) alone or with additional fat calories (3300 kcal and 57 percent fat calories). Carbohydrate (300 g/day) and protein (70 g/day) levels were kept constant. A four-day exercise program (total daily energy expenditure equal to 4645 +/- 237 kcal/day), was followed by a progressive treadmill test to exhaustion on day five. The exercise endurance times did not differ between the basal diet alone (106.1 +/- 11.2 min) or with additional fat calories (106.5 +/- 7.6 min). There were no significant physiologic differences between the groups at rest or during exercise. However, changes in resting blood chemistry and gas exchange indicated that fat metabolism predominated regardless of diet. In conclusion, (1) the fat content of rations has little short-term effect on either physiologic responses or physical performance of active soldiers, (2) short-term fat requirements can be met by using body fat stores, and (3) a dietary carbohydrate intake of 300 g/day is insufficient to prevent a transition from a carbohydrate- to a fat-predominant metabolism during four days of moderate exercise. GRA

N91-26729# Texas Univ., San Antonio.
ANALYSIS OF VISUAL LOSS FROM RETINAL LESIONS Annual Technical Report, 1 Sep. - 30 Nov. 1990
HAROLD LONGBOTHAM 12 Jul. 1990 5 p

(Contract AF-AFOSR-0490-89; AF PROJ. 2304)
(AD-A235268; AFOSR-91-0501TR) Avail: NTIS HC/MF A01
CSCL 06/4

Papers 1, 2, and 3 deal with the theory of Order Statistic filters. These nonlinear filter have proven useful for filtering impulsive, bursty, and additive i.i.d. noise. They are being used to analyze VEP (visual evoked potential) data here at USAFSAM/RZV. Paper 4 outlines their usefulness in the case of any periodic signal and as an example, their usage on VEP data taken here at USAFSAM/RZV. Papers 5 and 6 are our first efforts in the hexagonal sampling scheme. Paper 5 deals with the recording, manipulation and storage of hexagonally sampled data. Many other authors have worked on hexagonally sampled data. Many other authors have worked on hexagonally sampled data for various optimality reasons. In paper 6 we were able to show that ANN's for pattern classification were more easily trained (they were trained more quickly and would recognize more patterns) when sampled hexagonally. Paper 7 is the only paper that is not directly related to my research at BAFB. I decided I had to go back and present my work (masters thesis) in Quasi-Perfect codes due to the recent interest shown at IBM in double error correcting codes. GRA

N91-26730# Sloan-Kettering Inst. for Cancer Research, New York, NY.

WOUND HEALING BY CULTURED SKIN CELLS AND GROWTH FACTORS Report, 16 May 1988 - 15 Nov. 1989
MAGDALENA EISINGER 28 Aug. 1990 50 p
(Contract DAMD17-88-C-8105; DA PROJ. 3M1-62787-A-874)
(AD-A235300) Avail: NTIS HC/MF A03 CSCL 06/1

The studies described in this report were aimed at the biochemical characterization and purification of a wound healing growth factor, named Epidermal Cell derived Factor (EDF). The biological activity of EDF was found to embody enhancement of epidermal regeneration and regulation of dermal repair in skin wounds. We have accomplished the following: A tissue culture bioassay that is based on the capability of fibroblasts to contract collagen gels was shown to reflect in vivo effects of EDF on dermal cells and was adopted for examination of large numbers of samples during biochemical purification steps. Supernatant fluids of epidermal cell cultures and cell extracts of epidermal cells grown in tissue culture were tested as possible sources for purification of the factor, but substituted by epidermal cells obtained from animals following a superficial wounding. Cell extracts prepared from such regenerating epidermal cells have been found to be the richest source from all tissues tested. GRA

N91-26731# Uniformed Services Univ. of the Health Sciences, Bethesda, MD.

MOLECULAR STUDIES OF CYTOKINE INDUCTION Annual Report No. 1, Feb. - Nov. 1989

CARL W. DIEFFENBACH 8 Apr. 1991 20 p
(Contract N00014-90-J-1311; NR PROJ. RR0-4108)
(AD-A235326) Avail: NTIS HC/MF A03 CSCL 06/5

The immune system has evolved to respond to certain microbial products with a sequence of physiological events, termed the acute phase response, that appears to be adaptive. The molecular triggers for the acute phase response appear to be cell wall products such as endotoxin, in the case of bacteria and double stranded RNA, in the case of viruses. Both endotoxin and double stranded RNA induce a class of hormone like substances, cytokines, that drive the acute phase response. It is not known if bacterial and viral products induce overlapping sets of cytokines or if the virus response is completely dependent on interferon. Until now there has been no convenient way of assaying either serum for multiple cytokine activity, or detection of cytokine RNA's. To circumvent this problem, I have developed a polymerase chain reaction method (RNAPCR) for the detection and semi-quantitation of specific mRNA species. This method will detect mRNA in a range of 10-4 to 10-5 copies per cell allowing for a systematic analysis for multiple cytokines simultaneously. Data on the double stranded RNA induced production of cytokine mRNA's by the mouse macrophage line RAW is shown. Because the RNAPCR is

strand specific, the methodology can be used to monitor the production of double stranded RNA in infected tissues. The power of this technique is just beginning to be exploited. GRA

N91-26732# Aerojet Electrosystems Co., Azusa, CA.
PROCEEDINGS OF THE 12TH ANNUAL MEETING OF THE UIPS COMMISSION ON GRAVITATIONAL PHYSIOLOGY Final Report, 1 Sep. 1990 - 31 Aug. 1991
 N. PACE 16 Apr. 1991 252 p Meeting held in Leningrad, USSR, 14-18 Oct. 1990
 (Contract AF-AFOSR-0320-90; AF PROJ. 2312)
 (AD-A235337; AFOSR-91-0442TR) Avail: NTIS HC/MF A12 CSDL 06/10

Papers presented at the 12th Annual Meeting of the UIPS Commission on Gravitational Physiology are compiled. The gravitational effects on the physiological systems of humans, animals and plants are discussed. The effects of weightlessness during space flights, acute and chronic acceleration, vibration, and the various forms of simulated weightlessness are included, as well as consideration of the evolutionary consequences of gravity and the role of gravity in the manifestation of scale effects in animals and plants. Author

N91-27091*# Alabama Univ., Tuscaloosa. Health and Human Performance Studies.
TECHNIQUES FOR DETERMINING TOTAL BODY WATER USING DEUTERIUM OXIDE Final Report
 PHILLIP A. BISHOP In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 1 13 p Dec. 1990
 (Contract NGT-44-005-803)
 Avail: NTIS HC/MF A10 CSDL 06/16

The measurement of total body water (TBW) is fundamental to the study of body fluid changes consequent to microgravity exposure or treatment with microgravity countermeasures. Often, the use of radioactive isotopes is prohibited for safety or other reasons. It was selected and implemented for use by some Johnson Space Center (JSC) laboratories, which permitted serial measurements over a 14 day period which was accurate enough to serve as a criterion method for validating new techniques. These requirements resulted in the selection of deuterium oxide dilution as the method of choice for TBW measurement. The development of this technique at JSC is reviewed. The recommended dosage, body fluid sampling techniques, and deuterium assay options are described. Author

N91-27095*# Houston Baptist Univ., TX. Dept. of Biology.
NONLINEAR SYSTEMS DYNAMICS IN CARDIOVASCULAR PHYSIOLOGY: THE HEART RATE DELAY MAP AND LOWER BODY NEGATIVE PRESSURE Final Report
 JOHN C. HOOKER In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 1 12 p Dec. 1990
 (Contract NGT-44-005-803)
 Avail: NTIS HC/MF A10 CSDL 06/16

A preliminary study of the applicability of nonlinear dynamic systems analysis techniques to low body negative pressure (LBNP) studies. In particular, the applicability of the heart rate delay map is investigated. It is suggested that the heart rate delay map has potential as a supplemental tool in the assessment of subject performance in LBNP tests and possibly in the determination of susceptibility to cardiovascular deconditioning with spaceflight. Author

N91-27101*# Fordham Univ., New York, NY. Div. of Science and Mathematics.
A STUDY OF MURINE BONE MARROW CELLS CULTURED IN BIOREACTORS WHICH CREATE AN ENVIRONMENT WHICH SIMULATED MICROGRAVITY Final Report
 BROTHER DESALES LAWLESS In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 1 15 p Dec. 1990
 (Contract NGT-44-005-803)
 Avail: NTIS HC/MF A10 CSDL 06/16

Previous research indicated that mouse bone marrow cells

could be grown in conditions of simulated microgravity. This environment was created in rotating bioreactor vessels. On three attempts mouse cells were grown successfully in the vessels. The cells reached a stage where the concentrations were doubling daily. Phenotypic analysis using a panel of monoclonal antibodies indicated that the cells were hematopoietic pluripotent stem cells. One unsuccessful attempt was made to reestablish the immune system in immunocompromised mice using these cells. Since last summer, several unsuccessful attempts were made to duplicate these results. It was determined by electron microscopy that the cells successfully grown in 1989 contained virus particles. It was suggested that these virally parasitized cells had been immortalized. The work of this summer is a continuation of efforts to grow mouse bone marrow in these vessels. A number of variations of the protocol were introduced. Certified pathogen free mice were used in the repeat experiments. In some attempts the medium of last summer was used; in others Dexture Culture Medium containing Iscove's Medium supplemented with 20 percent horse serum and 10-6 M hydrocortisone. Efforts this summer were directed solely to repeating the work of last summer. Plans were made for investigations if stem cells were isolated. Immortalization of the undifferentiated stem cell would be attempted by transfection with an oncogenic vector. Selective differentiation would be induced in the stem cell line by growing it with known growth factors and immune response modulators. Interest is in identifying any surface antigens unique to stem cells that would help in their characterization. Another goal was to search for markers on stem cells that would distinguish them from stem cells committed to a particular lineage. If the undifferentiated hematopoietic stem cell was obtained, the pathways that would terminally convert it to myeloid, lymphoid, erythroid, or other cell lines would be studied. Transfection with a known gene would be attempted and then conversion to a terminally identifiable cell. Author

N91-27102*# Kansas State Univ., Manhattan. Dept. of Kinesiology.
THE EFFECTS OF DEUTERIUM ON STATIC POSTURE CONTROL Final Report
 CHARLES S. LAYNE In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 1 12 p Dec. 1990
 (Contract NGT-44-005-803)
 Avail: NTIS HC/MF A10 CSDL 06/16

A significant operational problem impacting upon the Space Shuttle program involves the astronaut's ability to safely egress from the Orbiter during an emergency situation. Following space flight, astronauts display significant movement problems. One variable which may contribute to increased movement ataxia is deuterium (D2O). Deuterium is present in low levels within the Orbiter's water supply but may accumulate to significant physiological levels during lengthy missions. Deuterium was linked to a number of negative physiological responses, including motion sickness, decreased metabolism, and slowing of neural conduction velocity. The effects of D2O on static postural control in response to a range of dosage levels were investigated. Nine subjects were divided into three groups of three subjects each. The groups were divided into a low, medium, and a high D2O dosage group. The subjects static posture was assessed with the use of the EquiTest systems, a commercially available postural control evaluation system featuring movable force plates and a visual surround that can be servoed to the subject's sway. In addition to the force plate information, data about the degree of subject sway about the hips and shoulders was obtained. Additionally, surface electromyographic (EMG) data from the selected lower limb muscles were collected along with saliva samples used to determine the amount of deuterium enrichment following D2O ingestion. Two baseline testing sessions were performed using the EquiTest testing protocol prior to ingestion of the D2O. Thirty minutes after dosing, subjects again performed the tests. Two more post-dosing tests were run with an interest interval of one hour. Preliminary data analysis indicates that only subjects in the high dose group displayed any significant static postural problems. Future analyses of the sway and EMG is expected to reveal significant variations in the subject's postural control strategy.

following D2O dosing. While functionally significant static postural problems were not commonly observed, subjects in both the medium and high dosage groups displayed significant, and in some cases, severe voluntary movement problems. Author

N91-27112*# Texas Lutheran Coll., Seguin. Dept. of Biology.
MECHANICS, IMPACT LOADS AND EMG ON THE SPACE SHUTTLE TREADMILL Final Report
WILLIAM G. SQUIRES /In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 2 3 p Dec. 1990 (Contract NGT-44-005-803)
Avail: NTIS HC/MF A09 CSCL 06/5

The ability of astronauts to egress the Shuttle, particularly during emergency conditions, is likely to be reduced following physiological adaptation in space. It is well established that effective application of exercise counter measures requires the exercise to be applied specifically. The problem is that objective scientific evidence is not available to validate the Space Shuttle treadmill with respect to in its role in diminishing the deleterious effects of a prolonged exposure to the microgravity environment. Author

N91-27114*# Philadelphia Coll. of Pharmacy and Science, PA. Dept. of Pharmacy Practice/Pharmacy Administration.
ASSESSMENT OF THE PHARMACODYNAMICS OF INTRANASAL, INTRAVENOUS AND ORAL SCOPOLAMINE Final Report
KAREN J. TIETZE /In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 2 14 p Dec. 1990 (Contract NGT-44-005-803)
Avail: NTIS HC/MF A09 CSCL 06/5

Space motion sickness is an important issue in the space medical sciences program. One of the objectives of the ongoing clinical experimental protocol Pharmacokinetics of Intranasal Scopolamine in Normal Subjects is to evaluate the pharmacodynamics of scopolamine using salivary flow rate and pH profiles and cognitive performance tests as pharmacodynamic parameters. Normal volunteers collected saliva and performed the NTI Multiresource Performance Battery tests at designed time intervals to establish control saliva flow rates, salivary pH profiles, and the characteristics of the learning curve for the performance program under normal conditions. In the clinical part of the study, saliva samples and performance test scores are collected from healthy nonsmoking subjects after receiving a single 0.4 mg dose of either intranasal, intravenous, or oral scopolamine. Author

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A91-40845* Illinois Univ., Urbana.
FRAMES OF REFERENCE FOR HELICOPTER ELECTRONIC MAPS - THE RELEVANCE OF SPATIAL COGNITION AND COMPONENTIAL ANALYSIS
KELLY HARWOOD and CHRISTOPHER D. WICKENS (Illinois, University, Urbana) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 1, no. 1, 1991, p. 5-23. refs (Contract NAG2-308)
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Computer-generated map displays for NOE and low-level helicopter flight were formed according to prior research on maps, navigational problem solving, and spatial cognition in large-scale environments. The north-up map emphasized consistency of object location, whereas, the track-up map emphasized map-terrain congruency. A component analysis indicates that different cognitive components, e.g., orienting and absolute object location, are supported to varying degrees by properties of different frames of reference. R.E.P.

A91-40846 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

PILOT PERSONALITY AND CREW COORDINATION - IMPLICATIONS FOR TRAINING AND SELECTION
THOMAS R. CHIDESTER (NASA, Ames Research Center, Moffett Field, CA), ROBERT L. HELMREICH (Texas, University, Austin), STEVEN E. GREGORICH (San Jose State University, CA), and CRAIG E. GEIS (U.S. Army, San Francisco, CA) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 1, no. 1, 1991, p. 25-44. NASA-supported research. refs
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It is contended that past failures to find linkages between performance and personality were due to a combination of premature performance evaluation, inadequate statistical modeling, and/or the reliance on data gathered in contrived as opposed to realistic situations. The goal of the research presented is to isolate subgroups of pilots along performance-related personality dimensions and to document limits on the impact of crew coordination training between the groups. Three different profiles were identified through cluster analysis of personality scales that replicated across samples and predicted attitude change following training in crew coordination. R.E.P.

A91-40847* Ohio State Univ., Columbus.
SITUATION AWARENESS - A CRITICAL BUT ILL-DEFINED PHENOMENON
NADINE B. SARTER and DAVID D. WOODS (Ohio State University, Columbus) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 1, no. 1, 1991, p. 45-57. refs (Contract NCC2-592)
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The significance of the temporal dimension of situation awareness is examined. Its study requires the staging of complex dynamic situations and the development of less intrusive in-flight probing techniques to assess the pilot's ability to adequately and rapidly retrieve and integrate flight-related information. The cognitive basis of the concept is analyzed, embedding it in the context of related psychological concepts. Methodological approaches to the investigation of situation awareness are discussed on this basis. R.E.P.

A91-40849
EXAMINING TRANSFER OF TRAINING USING CURVE FITTING - A SECOND LOOK
DIANE L. DAMOS (Southern California, University, Los Angeles, CA) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 1, no. 1, 1991, p. 73-85. refs (Contract N00014-86-K-0119)
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Curve fitting is a powerful method for examining transfer of training that has been essentially ignored by the aviation community. This article describes some of the advantages of curve fitting compared to traditional transfer-of-training formulas. Some of the practical problems associated with curve fitting and methods for circumventing them are discussed. Finally, data from a mental rotation experiment are analyzed using both curve fitting and a common transfer-of-training formula. The results from curve fitting clearly provide more detailed information about the skills that transferred and the magnitude of the effects. Author

A91-40850
SHOULD FLIGHT ATTENDANTS BE INCLUDED IN CRM TRAINING? - A DISCUSSION OF A MAJOR AIR CARRIER'S APPROACH TO TOTAL CREW TRAINING
MICHAEL J. VANDERMARK (America West Airlines, Inc., Phoenix, AZ) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 1, no. 1, 1991, p. 87-94. refs
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A description of the America West Airlines approach to total crew training is presented, namely, the inclusion of flight attendants in the aircrew team dynamics. Program design and implementation along with course objectives are described and the overall program is discussed from an organization development perspective.

Reflections on training flight attendants and pilots together are presented, and a review of what was learned while training the trainers is given. R.E.P.

A91-42782

PSYCHOLOGICAL ASPECTS OF PILOT SPATIAL ORIENTATION

P. A. KOVALENKO (Scientific Experimental Centre for Air Traffic Control Automation, USSR) ICAO Journal (ISSN 0018-8778), vol. 46, March 1991, p. 18-23.

Copyright

The study deals with such problems related to flight safety as the selection of a common approach to displaying bank and pitch in attitude indicators and addresses the responses of 410 test subjects. It is shown that pilots give the view-from-the-ground indicator a rating of 4.9 points on a scale of 5, while the view-from-the-aircraft indicator is given 3.4 points. About 60 pct of the pilots consider switching from one method of indicating attitude to another as the most undesirable situation. Spatial-orientation techniques used by pilots in different phases of flight are discussed along with the effectiveness and stability of such techniques. Models developed for the processing of spatial information with various spatial-orientation techniques are described, and pilot training results are analyzed. V.T.

A91-42790

CABIN CREW STRESS FACTORS EXAMINED

OMAR S. BARAYAN (Ministry of Defense and Aviation, Riyadh, Saudi Arabia) ICAO Journal (ISSN 0018-8778), vol. 46, May 1991, p. 9-11.

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Modifications in regulations to permit operation of long-range commercial transports using two-man crews have had an impact on cabin crews, especially with regard to increased stress. Mean ratings of ten task- and context-related stress factors in the cabin-crew environment during normal and peak workload periods are discussed. It is seen that the two-cockpit-crew concept requires greater self-reliance from the cabin crew which previously depended heavily on interface with the cockpit crew in their management of in-flight problems. It is concluded that under peak workload conditions context-related factors tend to be more stressful than task-related, while under normal workload conditions the task-related factors are likely to be perceived as more stressful. R.E.P.

A91-42791

TRAINING NEEDS FOR ADVANCED TECHNOLOGY FLIGHT DECKS

DANIEL MAURINO (International Civil Aviation Organization, Air Navigation Bureau, Montreal, Canada) ICAO Journal (ISSN 0018-8778), vol. 46, May 1991, p. 20, 21.

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A review is presented of the various issues raised by the advent of advanced automated technology flight decks, particularly in relation to design, certification, training, and operation. It is pointed out that overall aircraft knowledge should precede detailed instruction in automatic features, very specific aircraft systems information should be provided, and the interrelationships between various systems should be clearly taught and completely understood. It is noted that there is an undesirable tendency to consider older aircraft to be common with a new version of the same aircraft when considering crew training and rating. Even when the aircraft may look alike externally and their basic performances and systems may be similar, there are significant technological differences in the flight deck. Attention is given to the design of training scenarios that will address problems and advantages of automated flight decks. R.E.P.

A91-43245

THE DEVELOPMENT OF PURSUIT TRACKING SKILLS

M. V. FROLOV, E. P. SVIRIDOV, G. B. MILOVANOVA, and I. V. ANDREEV (AN SSSR, Institut Vyshei Nervnoi Deiatel'nosti i Neurofizologii, Moscow, USSR) Aviation, Space, and

Environmental Medicine (ISSN 0095-6562), vol. 62, July 1991, p. 670-672.

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This article examines the development of the visual-motor skill of pursuit tracking. Parameters studied include tracking error and emotional tension, as manifested in heart rate and strength of grip exerted on the control handle used in the task. A specially developed device converted grip strength into an electrical signal suitable for analysis. Grip strength proved to be a more sensitive indicator of development and level of skill than traditionally used parameters of tracking error stabilization and minimization of emotional-autonomic shifts. Computation of the ratio of grip strength to tracking error makes it possible to estimate the 'physiological cost' and, thus, reliability of operator performance. The device for registering grip strength is incorporated into the control system and may be used in systems providing continuous diagnostic information without interfering with operator performance. Author

A91-43999

A PSEUDOMATCHED FILTER MODEL APPLIED TO THE TRANSIENT SYSTEM OF HUMAN VISION

ALBERTUS C. DEN BRINKER, HANS A. L. PICENI, and FRANS E. W. VERVUURT (Eindhoven University of Technology, Netherlands) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. 38, May 1991, p. 502-510. Research supported by Eindhoven University of Technology. refs

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A pseudomatched filter configuration is presented as a model for the transient system of human visual perception. This model resembles the models proposed by Reichardt (1971) and Rashbass (1970), but the pseudomatched filter model is linear. The choice of the model is based on the shape of the psychophysically measured impulse response and on physiological and functional arguments. The parameters of the model are estimated for different data sets. The model was fitted to experimentally determined impulse responses of the transient channel of the visual system. In most cases the model's parameters were found, so a reasonable fit was obtained. It was found that under the same conditions (background level and field diameter) the estimated model was essentially the same for different subjects. Comparison of the results from the fits at different background levels showed that from the three parameters in the model only the angular frequency changed by more than the estimated standard deviation. It is shown that the model is in agreement with other psychophysical data. This is shown by predicting the threshold-versus-duration curve and the sensitivity to sinusoidal stimuli. The model's threshold-versus-duration curves agree well with the experimental data. I.E.

A91-44341#

PRACTICING FORBIDDEN THRILLS

DAVID K. JONES (CAE-Link Corp., Binghamton, NY) Aerospace America (ISSN 0740-722X), vol. 29, July 1991, p. 26-29.

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The subsystems and operational aspects of the F-16C Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) are described. This trainer permits the pilot to fly 100 ft above ground contours at night at 450 knots while maneuvering to avoid anti-aircraft fire and missiles in the safety of a simulator. LANTIRN consists of two pods; one for targeting that contains the target acquisition system, missile boresight correlator, and laser designator and ranger; and one for navigation that contains the fixed imaging navigation sensor and automatic terrain-following radar (TFR). This simulator models TFR, navigation IR video, targeting IR video, handoff, tracking, laser designator and ranger, and Maverick IR video and tracking. R.E.P.

N91-25130# Air Force Systems Command, Kirtland AFB, NM. Directorate of Aerospace Studies.

KNOWLEDGE EXTRACTION METHODS FOR THE DEVELOPMENT OF EXPERT SYSTEMS

MANUEL PEREZ, LEOPOLDO GEMOETS, and ROBERT G. MCINTYRE (Texas Univ., El Paso.) In AGARD, Knowledge Based

System Applications for Guidance and Control 10 p Apr. 1991
Copyright Avail: NTIS HC/MF A12; Non-NATO Nationals requests
available only from AGARD/Scientific Publications Executive

The development of expert systems require the use of engineering techniques which can be used to efficiently and correctly extract the domain knowledge resident within the human expert. To apply these techniques, certain conditions must be met. These conditions are that the candidate expert system domain must be suitable for implementation, that there be a knowledge engineer with a certain level of domain knowledge, and that the right human domain experts be selected in the expert system development effort. A semi-sequential approach to development of techniques is presented which can be used to extract the knowledge from the human expert. Presented are both direct and indirect methods which a knowledge engineer can use to extract this knowledge. Author

N91-25601* # Bio-Dynamics Research and Development Corp., Eugene, OR.

USER ACCEPTANCE OF INTELLIGENT AVIONICS: A STUDY OF AUTOMATIC-AIDED TARGET RECOGNITION

CURTIS A. BECKER, BRIAN C. HAYES, and PATRICK C. GORMAN May 1991 19 p Prepared in cooperation with Army Aviation Systems Command, Moffett Field, CA (Contract NAS2-12849)

(NASA-CR-177583; A-91095; NAS 1.26:177583; AVSCOM-TR-90-A-009) Avail: NTIS HC/MF A03 CSCL 05I

User acceptance of new support systems typically was evaluated after the systems were specified, designed, and built. The current study attempts to assess user acceptance of an Automatic-Aided Target Recognition (ATR) system using an emulation of such a proposed system. The detection accuracy and false alarm level of the ATR system were varied systematically, and subjects rated the tactical value of systems exhibiting different performance levels. Both detection accuracy and false alarm level affected the subjects' ratings. The data from two experiments suggest a cut-off point in ATR performance below which the subjects saw little tactical value in the system. An ATR system seems to have obvious tactical value only if it functions at a correct detection rate of 0.7 or better with a false alarm level of 0.167 false alarms per square degree or fewer. Author

N91-26695# Joint Publications Research Service, Arlington, VA. INDIVIDUAL STEREOTYPES OF HUMAN NEUROPSYCHIC PROGNOSTIC ACTIVITY IN PROBLEM SITUATIONS WITH DIFFERENT PROBABILITY STRUCTURES

A. KRAUKLIS and I. KAZANOVSKAYA In its JPRS Report: Science and Technology. USSR: Life Sciences p 19-25 18 Apr. 1991 Transl. into ENGLISH from Izvestiya Latvyskoy Akademii Nauk (Riga, USSR), no. 9, Sep. 1990 p 86-96
Avail: NTIS HC/MF A05

The formation of man's adaptive psychophysiological reactions, their individual variants and different degrees of adaptive effectiveness in problem situations were studied by a decision-making model. It was established that the form of manifestation depends in the probability structure of the problem situation. Every subject displayed substantial difference in individual speed in forming an adequate pattern of action after a stereotype signal sequence, with motor automation preceding detection of the stereotype signal sequence. On the basis of the time required by the subjects to detect the stereotype presentation of signals, the dynamics of the problem-solving time and the intensity of effector reactions, individual variants of neuropsychic self-regulation stereotypes characterized by differing adaptive effectiveness were revealed. Author

N91-26700# Joint Publications Research Service, Arlington, VA. EFFECT OF SHIFT WORK OF AIR TRAFFIC CONTROLLERS ON SYMPATHETIC NERVOUS SYSTEM Abstract Only

YE. L. KAN and V. A. KUPRIYANOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-2 20 May 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i

Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 5, Sep. - Oct. 1990 p 22-25
Avail: NTIS HC/MF A03

A comprehensive analysis was conducted on humoral factors reflective of the sympathetic nervous system (SNS) in 21 male air traffic controllers, 25 to 35 years old. Urinary monitoring demonstrated that night shift represented the most stressful job situation despite the relatively light work load and was attended by highest excretion of norepinephrine. In addition, individuals were identified during every shift (early morning, day, night) who presented with diminished catecholamine excretion, indicative of adaptive failure and depletion of the functional reserves of the SNS. Correlation of norepinephrine excretion with epinephrine concentrations demonstrated synchronization between neural and endocrine mechanisms in adaptation to working conditions. However, negative correlation coefficients between norepinephrine and DOPA and dopamine, especially during night work, provided further evidence of SNS exhaustion. Author

N91-26733# Office of Naval Research, Arlington, VA. COGNITIVE AND NEURAL SCIENCES DIVISION 1990 PROGRAMS Summary Report, 1 Oct. 1989 - 30 Sep. 1990
WILLIARD S. VAUGHAN Aug. 1990 252 p
(AD-A233773; OCNR-114290-17) Avail: NTIS HC/MF A12 CSCL 05/8

Cognitive and Neural Sciences Division programs are carried out under contracts and grants awarded on the basis of proposals received in response to a broad agency announcement in the Commerce Business Daily. They are evaluated on the scientific merit of the proposed research, the facilities available for its conduct, the competence of the principal investigators, and relevance to Navy needs. The elements that shape our research program are scientific gaps and opportunities, and operational needs identified in Navy planning documents. Our overall aim is to support quality science for the good of the Navy and the nation. GRA

N91-26734# California Univ., Irvine. Center for the Neurobiology of Learning and Memory.

MECHANISMS OF ADAPTIVE INFORMATION PROCESSING Final Report, 1 Jun. - 30 Sep. 1990

NORMAN M. WEINBERGER 30 Sep. 1990 7 p
(Contract N00014-90-J-1815)

(AD-A234435) Avail: NTIS HC/MF A02 CSCL 06/3

It has long been known that associative processes rapidly induce increased responses to acoustic signals in the auditory cortex. This facilitation could be due either to a general increase in responsivity to acoustic (or even all sensory) stimulation, or to a specific change in the way that information is processed, represented and stored, i.e., it could reflect adaptive information processing. Our previous studies have resolved that issue by determining the effects of classical conditioning on the frequency receptive fields of neurons in the auditory cortex. They provided unequivocal support that learning involves adaptive information processing (Diamond and Weinberger, 1986; 1989). Thus, responses to the CS frequency were specifically increased whereas responses to other frequencies, including the pre-training best frequency, were reduced. This pattern of change was often large enough to produce a strong retuning of cells such that the frequency of the CS became the best frequency (Bakin and Weinberger, 1990). This project tests a model of such adaptive information processing. GRA

N91-26735# Stanford Univ., CA. Dept. of Psychology. INDUCED PICTORIAL REPRESENTATIONS Final Technical Report, 1 Dec. 1989 - 31 Jan. 1991

BARBARA TVERSKY 15 Feb. 1991 77 p
(Contract AF-AFOSR-0076-89; AF PROJ. 2313)
(AD-A234548; AFOSR-91-0284TR) Avail: NTIS HC/MF A05 CSCL 05/8

When understanding discourse, people form mental representations at many levels, including a model of the situation. This report describes two projects investigating spatial mental

models induced by text. The first explored characteristics of static mental models of environments established from survey or route descriptions. Memory measures indicated that descriptions from both perspectives appear to induce the same perspective-free mental models. Like structural descriptions, these mental models incorporate spatial relations among landmarks, and allow the taking of many specific perspectives. In the second project, narratives described a common situation, an observer surrounded by objects. Narratives periodically reoriented observers, and subjects were probed for objects at various directions from the body of the observer. The pattern of reaction times suggested that people form mental spatial frameworks to keep track of the positions of objects relative to the observer. Spatial frameworks are not image - or perception-like, but rather reflect people's conceptions of space based on typical interactions with space. GRA

N91-26736# Army Health Care Studies and Clinical Investigation Activity, Fort Sam Houston, TX.

PROCEEDINGS OF THE 7TH USER'S STRESS WORKSHOP

Final Report, Dec. 1989 - Dec. 1990

A. D. MANGELSDORFF Dec. 1990 246 p Workshop held in San Antonio, TX, 10-15 Dec. 1989 (AD-A234583; HCSCIA-CR91-001) Avail: NTIS HC/MF A11 CSCL 06/5

The proceedings document the presentations at a workshop conducted in December 1989 on the training programs designed for managing psychological trauma and stress. The interaction between local, national, and international efforts was examined. The program was designed to provide up to date information and skills to health and emergency service providers on how to recognize, treat, and manage victims of psychic trauma. The program was presented in lecture, discussion, practical exercises, and role playing situations. GRA

N91-26737# Oregon State Univ., Newport. Marine Science Center.

PARALLEL PROCESSING AND LEARNING: VARIABILITY AND CHAOS IN SELF-ORGANIZATION OF ACTIVITY IN GROUPS OF NEURONS Annual Report, 14 Jan. 1990 - 13 Jan. 1991

GEORGE J. MPITSOS 8 Mar. 1991 9 p (Contract AF-AFOSR-0262-89; AF PROJ. 2312) (AD-A234589; AFOSR-91-0243TR) Avail: NTIS HC/MF A02 CSCL 06/5

We have examined the immunohistochemical localization of over 12 different neurotransmitters in all of the nervous system components of two different marine molluscs, *Aplysia* and *Pleurobranchaea*. To do this for each neurotransmitter, we made complete serial histological sections of all major ganglia in each nervous system. Localizations were performed using immunohistochemistry and fluorescence microscopy. Since many of the commercially available antisera proved to be nonspecific, we generated 11 antisera in our laboratory. One of the major achievements occurred in our work on acetylcholine, which our previous AFOSR-funded work implicated as having an important role in associative learning in *Pleurobranchaea* through muscarinic receptors. GRA

N91-26738# Systems Research Labs., Inc., Dayton, OH. **AIRCREW EVALUATION SUSTAINED OPERATIONS PERFORMANCE (AESOP): A TRISERVICE FACILITY FOR TECHNOLOGY TRANSITION Interim Report, Sep. 1987 - Sep. 1990**

SAMUAL E. SCHIFLETT, DAVID R. STROME, DOUGLAS R. EDDY, and MATHIEU A. DALRYMPLE Dec. 1990 32 p Prepared in cooperation with NTI, Inc., Dayton, OH (Contract F33615-87-D-0601) (AD-A234626; USAFSAM-TP-90-26) Avail: NTIS HC/MF A03 CSCL 06/10

A primary mission of the Sustained Operations Branch, Crew Technology Div., Armstrong Lab. (AFSC), is to develop procedures and provide guidance to operational commands on maintaining and extending crew performance during sustained operations and continuous duty. The Crew Technology Div. developed the AESOP

facility to meet the triservice research and mission requirements for team performance metrics. The AESOP facility evaluates the interactive effects of fatigue, stress, and medications on AWACS aircrew performance so effective countermeasures can be transitioned from the laboratory to field test environments to actual operations. The basic design of the facility allows the flexibility and experimental control to either assess performance decrements or develop performance enhancement techniques in a realistic operational environment. The simulation integrates hardware and software resources, data collection and analysis systems, verbal communication networks, command/control scenarios, and performance measures. Examples of individual and team performance on complex decision making are illustrated. Emphasis is placed on flexibility of measurement, hierarchical organization of measurement levels, and data collection from multiple perspectives. Future research opportunities for the development and evaluation of candidate models to describe and predict team decision making under stress from the perspective of operational performance-based criteria are identified. GRA

N91-26739# Massachusetts Univ., Amherst. Dept. of Psychology.

A CONFERENCE ON EYE MOVEMENTS AND VISUAL COGNITION Final Technical Report, 1 Jan. - 31 Dec. 1990

KEITH RAYNER 4 Mar. 1991 31 p Conference held in Amherst, MA, Aug. 1990 (Contract AF-AFOSR-0073-90; AF PROJ. 2313) (AD-A234754; AFOSR-91-0255TR) Avail: NTIS HC/MF A03 CSCL 06/4

This report summarizes a conference held in Amherst, MA in August 1990. The conference brought together investigators interested in a number of topics relevant to eye movements and visual cognition. Papers were presented on the following topics: (1) Programming saccades, (2) Visual Search and Integration, (3) Scene Perception, (4) Reading, and (5) Reading and Pictures. The conference was very stimulating, the talks were excellent, and the participants agreed that the meeting was very worthwhile. An edited volume will appear in 1992 with the conference papers. GRA

N91-26740# York Univ., Downsview (Ontario).

VISUAL SENSITIVITIES AND DISCRIMINATIONS AND THEIR ROLE IN AVIATION Final Report, 1 Nov. 1989 - 31 Oct. 1990

DAVID REGAN 20 Feb. 1991 81 p (Contract F49620-88-C-0002) (AD-A234866; AFOSR-91-0237TR) Avail: NTIS HC/MF A05 CSCL 01/3

Selective blindness to approaching or receding motion in depth exists and seems to be not uncommon in normally-sighted individuals. Of 16 subjects, 8 had visual field defects for either approaching or receding motion. Of 21 subjects, only 6 had full symmetrical fields for oscillatory motion in depth. Visual sensitivity to sideways motion was normal in stereomotion-blind areas. The possible relevance to aviation is pointed out. A perfectly camouflaged bar within a random dot pattern was rendered visible by moving dots within the bar and outside the bar with equal and opposite velocities (motion parallax). The bar's orientation could be judged with equal precision (0.5 deg) to that of an uncamouflaged dotted bar made visible by brightness contrast providing that dot speed and contrast were high. But when contrast was reduced, discrimination collapsed for the camouflaged bar. Shape discrimination was compared for motion-defined and contrast-defined dotted rectangles. At high dot speeds and contrasts aspect ratio discrimination equal for the two kinds of rectangle and, at 2 to 3 percent, corresponded to a change of side length of only 24 arc sec. GRA

N91-26741# Chicago Univ., IL. Dept. of Psychology.

CATEGORIES AND PARTICULARS: PROTOTYPE EFFECTS IN ESTIMATING SPATIAL LOCATION Annual Report, 1 Mar. 1990 - 28 Feb. 1991

JANELLEN HUTTENLOCHER, L. V. HEDGES, and S. DUNCAN 12 Mar. 1991 80 p

(Contract AF-AFOSR-0218-90; AF PROJ. 2313)
(AD-A234955; AFOSR-91-0245TR) Avail: NTIS HC/MF A05
CSCL 05/8

A final version was completed of a paper describing a model of spatial estimation based on hierarchical representation in memory. In the paper, the model to the representation of spatial location was applied, and results were reported on four experiments on coding the location of a dot in a circle. In addition, four other studies of ways people hierarchically organize other shapes and of the consequent effects of spatial estimation were carried out. The later studies raise various issues which have led to greater refinement in modeling people's reports of location under conditions of uncertainty. GRA

N91-26742# Johns Hopkins Univ., Baltimore, MD. Dept. of Psychology.

NEURAL MECHANISMS OF ATTENTION Annual Report, 1
Aug. 1989 - 31 Jul. 1990

DAVID OLTON and HOWARD EGETH Sep. 1990 9 p
(Contract AF-AFOSR-0481-89; AF PROJ. 2313)
(AD-A235003; AFOSR-91-0242TR) Avail: NTIS HC/MF A02
CSCL 05/8

Assessment of attention in animals provides information about the neural mechanisms involved in attention, which can help develop computational and cognitive models that describe in detail the systematic steps mediating different types of attention. In order to increase the applicability of the results from these experiments to those of humans, the behavioral testing procedures have been designed to be as similar as possible to those used for humans. The initial behavioral experiments indicate strong operational and psychological validity of these tests of attention, providing the opportunity to pursue the neural mechanisms in the subsequent funding period. GRA

N91-26743# Human Engineering Labs., Aberdeen Proving Ground, MD.

THE EFFECTS OF DISPLAY FAILURES AND SYMBOL ROTATION ON VISUAL SEARCH AND RECOGNITION PERFORMANCE

JENNIE J. DECKER, CRAIG J. DYE, CHARLES J. LLOYD, and HARRY L. SNYDER Feb. 1991 42 p
(Contract DA PROJ. 1L1-62716-AH-70)
(AD-A235035; HEL-TM-4-91) Avail: NTIS HC/MF A03 CSCL 23/2

This study was conducted to investigate the effects of display failures and rotation of dot-matrix symbols on visual search and recognition performance. The type of display failure (cell, horizontal line, vertical line), failure mode (On, failures matched the symbols; Off, failures matched the background), percentage of cells failed (0, 1, 2, 3, 4 percent), and rotation angle (0, 70, 105 deg) were the variables examined. Results showed that displays that exhibit On cell failures greater than 1 percent significantly affect search time performance. Cell failures degrade performance more than line failures. Search time and accuracy are best when symbols are oriented upright. The effects of display failures and rotation angle on search time were found to be independent. Implications for display design and suggestions for quantifying the distortion caused by rotation are discussed. GRA

N91-26744# University of Southern California, Los Angeles. Dept. of Psychology.

INTEGRATION OF NEUROBIOLOGICAL AND COMPUTATIONAL ANALYSES OF THE NEURAL NETWORK ESSENTIALS FOR CONDITIONED TASTE AVERSION Final Progress Report, 15 Dec. 1988 - 14 Mar. 1991

KATHLEEN C. CHAMBERS 29 Apr. 1991 15 p
(Contract N00014-89-J-1296)
(AD-A235164) Avail: NTIS HC/MF A03 CSCL 05/8

The general goal of this project was to determine the neural basis of learning and memory, that is, how the brain stores and retrieves memory. The special form of learning which was the focus of this project was conditioned taste aversions, learned aversions to the taste of food or fluid when consumption of that

substance is followed by illness. Studies were made of the illness pathway and illness-taste integration pathway. Conditions under which endogenous substances act as illness-inducing agents were determined, techniques to study neural substrates for those substances as well as exogenous toxins were developed and evidence refuting hypotheses regarding the role of particular brain areas as substrates for illness-integration was obtained. Endogenous factors that modulate the acquisition and extinction of conditioned taste aversions were also identified. Variations in endogenous hormone levels, availability of water, and age alter the facility with which an aversion is learned and unlearned. Finally, a neural model encompassing the illness pathway, the taste pathway, the behavioral pathways, and the modulatory pathways was developed. GRA

N91-27097*# Houston Univ., TX. Dept. of Psychology.

TRAINING EFFECTIVENESS OF AN INTELLIGENT TUTORING SYSTEM FOR A PROPULSION CONSOLE TRAINER Final Report

DEBRA STEELE JOHNSON *In its* NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 1 15 p Dec. 1990
(Contract NGT-44-005-803)

Avail: NTIS HC/MF A10 CSCL 05/9

A formative evaluation was conducted on an Intelligent Tutoring System (ITS) developed for tasks performed on the Propulsion Console. The ITS, which was developed primarily as a research tool, provides training on use of the Manual Select Keyboard (MSK). Three subjects completed three phases of training using the ITS: declarative, speed, and automaticity training. Data were collected on several performance dimensions, including training time, number of trials performed in each training phase, and number of errors. Information was also collected regarding the user interface and content of training. Suggestions for refining the ITS are discussed. Further, future potential uses and limitations of the ITS are discussed. The results provide an initial demonstration of the effectiveness of the Propulsion Console ITS and indicate the potential benefits of this form of training tool for related tasks.

Author

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A91-40848

DISPLAY MAGNIFICATION FOR SIMULATED LANDING APPROACHES

GAVAN LINTERN and JEFFERSON M. KOONCE (Illinois, University, Savoy) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 1, no. 1, 1991, p. 59-72. refs
(Contract MDA903-86-C-0169)

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Previous discussions of simulated landings suggest that biases not found during aircraft flight are induced by one or more features of a simulator. Inadequate representation of texture or of ground detail and distortions in judgments of size from near accommodation to a display are two of the factors that have been thought to contribute to these biases. Addition of surface detail and magnification of the display have been suggested as corrective solutions. The research reported here was a preliminary investigation of the effects of factors that might induce biased landing approaches in a simulator and of a procedure for calibrating a simulator to eliminate biases. Scene content, display magnification, runway size, and start point all influenced glideslope control. With an appropriate start point and appropriate runway dimensions, there was a close correspondence between

performance in an aircraft and performance in a simulator in which the display magnification had been set at unity and in which a moderate level of scene detail was presented. Author

A91-41445

SOME HUMAN FACTORS ASPECTS OF SINGLE MANNING

V. D. HOPKIN (RAF, Institute of Aviation Medicine, Farnborough, England) (Royal Institute of Navigation, Nautical Institute, and Honourable Company of Master Mariners, Joint Seminar, London, England, Dec. 6, 1989) Journal of Navigation (ISSN 0373-4633), vol. 43, Sept. 1990, p. 343-352. refs

Copyright

Human factors involved in single manning of aircraft and ocean vehicles are discussed. Special attention is given to human problems associated with single manning, including the necessity of continuous 'monitoring' (i.e. staying alert and attentive and scanning continuously for long periods for signals that are relatively rare, irregular, small, and/or transient), the inactivity that may be associated with it, and human limitations. The alternatives to single manning are discussed, and problems associated with single manning are compared with those of team manning. It is emphasized that single manning has advantages for people who like to be in sole charge and like the autonomy, and that these personality traits should influence the choice of personnel for single manning operations. I.S.

A91-41485* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

STEREOSCOPIC DISPLAYS AND APPLICATIONS; PROCEEDINGS OF THE MEETING, SANTA CLARA, CA, FEB. 12-14, 1990

JOHN O. MERRITT, ED. (Interactive Technologies, Williamsburg, MA) and SCOTT S. FISHER, ED. (NASA, Ames Research Center, Moffett Field, CA) Meeting sponsored by SPIE and Society for Imaging Science and Technology. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 1256), 1990, 336 p. For individual items see A91-41486 to A91-41500.

(SPIE-1256) Copyright

The present conference discusses topics in the fields of stereoscopic displays' user interfaces, three-dimensional (TD) visualization, novel TD displays, and applications of stereoscopic displays. Attention is given to TD cockpit displays, novel computational control techniques for stereo TD displays, characterization of higher-dimensional presentation techniques, volume visualization on a stereoscopic display, and stereoscopic displays for terrain-data base visualization. Also discussed are the experimental design of cyberspaces, a volumetric environment for interactive design of three-dimensional objects, videotape recording of TD TV images, remote manipulator tasks rendered possible by stereo TV, TD endoscopy based on alternating-frame technology, and advancements in computer-generated barrier-strip autostereography. O.C.

A91-41486

THREE-DIMENSIONAL STEREOSCOPIC DISPLAY IMPLEMENTATION - GUIDELINES DERIVED FROM HUMAN VISUAL CAPABILITIES

CHRISTOPHER D. WICKENS (Illinois, University, Savoy) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 2-11. USAF-supported research. refs

Copyright

The benefits and the costs of three-dimensional displays are first discussed. Then the different depth cues which are used to perceive depth are reviewed and the conclusions of psychological studies which have examined these cues in combination are reported. These conclusions generally support an additive linear model of depth perception with heavy weighting given to binocular disparity, motion parallax, and interposition. However, the presence of motion sometimes reduces the salience of disparity. Techniques

for implementing both stereoscopic and perspective displays are then reviewed in detail. Author

A91-41487

COMPARISON OF DEPTH CUES FOR RELATIVE DEPTH JUDGMENTS

WILLIAM F. REINHART, ROBERT J. BEATON, and HARRY L. SNYDER (Virginia Polytechnic Institute and State University, Blacksburg) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 12-21. refs

Copyright

Results are presented from two perceptual experiments in which subjects judged the relative depth-ordering and subjective depth of a circle, a square, and a triangle, using combinations of four sources of depth information to construct exemplary three-dimensional images. The sources were (1) relative size, (2) binocular disparity, (3) interposition, and (4) luminance. While inclusion of each of the three monocular cues produced significantly faster depth judgments, there was a lack of significant response time effects associated with binocular disparity. Stereo presentations substantially improved subjective image quality ratings. O.C.

A91-41488

FOCUSED AND DIVIDED ATTENTION IN STEREOSCOPIC DEPTH

CHRISTOPHER D. WICKENS, ARTHUR KRAMER, JOHN ANDERSEN, ANDRIA GLASSER, and KEN SARNO (Illinois, University, Savoy) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 28-34. Honeywell Systems, Inc.-sponsored research. refs

Copyright

The effect on focused and divided attention of 'depth-plane distance', as operationally defined by binocular disparity, has been evaluated in two experiments in which disparity was manipulated by a stereoscopic three-dimensional display system. In the first experiment, the distractors showed evidence of being processed when they lay at the depth plane of the central relevant stimulus; this is seen as evidence for a 'narrow' attention bandwidth in depth for focused attention. In the second experiment, involving two competing tasks, there was no evidence that interference was modulated by similarity of depth when the depth plane of stimulus presentation was known in advance, suggesting that attentional bandwidth in depth is sufficiently broad to accommodate the same range of depth planes over which filtering had been observed in focused attention. O.C.

A91-41489

3-D DISPLAYS FOR COCKPITS - WHERE THEY PAY OFF

JOHN M. REISING (USAF, Cockpit Integration Directorate, Wright-Patterson AFB, OH) and KIM M. MAZUR (Boeing Aerospace and Electronics, Seattle, WA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 35-43. refs

Copyright

Recent advancements in display technologies invite the incorporation of three-dimensional stereo into civilian and military aircraft cockpit-display formats, dramatically decreasing pilots' information-processing load through the creation of more realistic portrayals of real-world scenes. An account is given of the results obtained in a series of experiments evaluating the 'payoff' of combinations of three-dimensional stereo imagery with such monocular depth clues as size-coding and aerial perspective. It is found that three-dimensional stereo technology is most effective in display formats which attempt to portray spatial relationships lacking strong intrinsic monocular-depth cues. O.C.

A91-41490* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

EFFECT ON REAL-WORLD DEPTH PERCEPTION FROM EXPOSURE TO HEADS-DOWN STEREOSCOPIC FLIGHT DISPLAYS

ANTHONY M. BUSQUETS, STEVEN P. WILLIAMS, and RUSSELL V. PARRISH (NASA, Langley Research Center, Hampton, VA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 44-53. refs Copyright

A stereoacuity test was used as part of the experimental protocol of a study in which eight transport pilots flew repeated simulated landing approaches using both stereo and nonstereo three-dimensional heads-down 'pathway in the sky' displays. At the decisionmaking crux of each approach, the pilots transitioned to a stereoacuity test employing real objects rather than a two-dimensional target apparatus. A statistical analysis of stereoacuity measures which compared a controlled condition of no exposure to any electronic flight display with the transition data from nonstereo and stereopsis displays indicated no significant differences for any of the conditions. O.C.

A91-41491 PERSPECTIVE AND STEREO FOR PROJECTION FROM AND DISPLAY OF FOUR DIMENSIONS

WILLIAM P. ARMSTRONG (Evans and Sutherland Computer Corp., Salt Lake City, UT) and ROBERT P. BURTON (Brigham Young University, Provo, UT) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 54-61. Copyright

Two widely used techniques for displaying three-dimensional objects on two-dimensional screens are perspective and stereo. It is presently shown that, by extrapolating perspective and stereo, it is possible to create images which encode information from four or more dimensions onto visual cues; these images can convey a sense of 'four-dimensional' objects. A total of nine types of image is shown to be obtainable by these means. O.C.

A91-41492* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

NEW COMPUTATIONAL CONTROL TECHNIQUES AND INCREASED UNDERSTANDING FOR STEREO 3-D DISPLAYS

STEVEN P. WILLIAMS and RUSSELL V. PARRISH (NASA, Langley Research Center, Hampton, VA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 73-82. refs Copyright

While conventional asymptotic transformations for mapping a visual scene onto a stereo viewing volume allow a single, specific scene-distance to be fixed at the screen location, the present piecewise linear approach allows creative partitioning of the depth viewing volume and affords the freedom to place depth-cueing emphasis wherever desired. Attention is given to the results of an experiment with the novel system which attempted to ascertain the effective region of stereopsis cueing. A practical viewing volume falls between -25 and +60 percent of the viewer-to-screen distance. The data indicate that increased viewer-to-CRT distances furnish increasing usable depth. O.C.

A91-41493* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

DEFINING, MODELING, AND MEASURING SYSTEM LAG IN VIRTUAL ENVIRONMENTS

STEVE BRYSON (NASA, Ames Research Center; Sterling Federal Systems, Inc., Moffett Field, CA) and SCOTT S. FISHER (NASA, Ames Research Center, Moffett Field, CA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical

Instrumentation Engineers, 1990, p. 98-109. refs Copyright

In such real-time interactive computer environments as those used for virtual environments and simulators, system lag dramatically affects system usability. Attention is presently given to two types of lag: (1) transmission lag time, which is the difference between the moving of a sensing device and that device's motion on a graphic display, and (2) position lag, which is the difference between the actual position of a tracker in motion and the displayed position of a tracker at the same time. A method for measuring these types of lag using a video technique was developed for the NASA-Ames Virtual Interactive Environment Workstation. The position lag can be understood in terms of the transmission lag, so that optimizing a system for small transmission lag will also optimize for small position lag. O.C.

A91-41494* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

HEAD-COUPLED REMOTE STEREOSCOPIC CAMERA SYSTEM FOR TELEPRESENCE APPLICATIONS

M. T. BOLAS (Fake Space Laboratories, Palo Alto, CA) and S. S. FISHER (NASA, Ames Research Center, Moffett Field, CA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 113-123. refs Copyright

The Virtual Environment Workstation Project (VIEW) at NASA's Ames Research Center has developed a remotely controlled stereoscopic camera system that can be used for telepresence research and as a tool to develop and evaluate configurations for head-coupled visual systems associated with space station telerobots and remote manipulation robotic arms. The prototype camera system consists of two lightweight CCD video cameras mounted on a computer controlled platform that provides real-time pan, tilt, and roll control of the camera system in coordination with head position transmitted from the user. This paper provides an overall system description focused on the design and implementation of the camera and platform hardware configuration and the development of control software. Results of preliminary performance evaluations are reported with emphasis on engineering and mechanical design issues and discussion of related psychophysiological effects and objectives. Author

A91-41495 STEREOSCOPIC DISPLAYS FOR TERRAIN DATABASE VISUALIZATION

HARRY VERON, DAVID A. SOUTHARD, JEFFREY R. LEGER, and JOHN L. CONWAY (Mitre Corp., Bedford, MA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 124-135. refs (Contract F19628-89-C-0001) Copyright

Commercially available liquid-crystal stereoscopic shutters (LCSS) allow the incorporation of stereoscopic three-dimensional in moderately priced graphics workstations. An account is presently given of the results of a USAF evaluation of stereoscopic three-dimensional data for terrain-data visualization which required the implementation of algorithms for the management and filtering of terrain and cultural feature data bases in order to obtain optimal geometric terrain models. The visualization of a mission planning and rehearsal system was achieved. O.C.

A91-41496* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

IMPLEMENTATION AND INTEGRATION OF A COUNTERBALANCED CRT-BASED STEREOSCOPIC DISPLAY FOR INTERACTIVE VIEWPOINT CONTROL IN VIRTUAL ENVIRONMENT APPLICATIONS

I. E. MCDOWALL, M. BOLAS, S. PIEPER, S. S. FISHER, and J. HUMPHRIES (NASA, Ames Research Center, Moffett Field, CA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA,

Society of Photo-Optical Instrumentation Engineers, 1990, p. 136-146. refs

Copyright

The NASA-Ames Counterbalanced CRT-based Stereoscopic Viewer (CCSV), which is being used as a viewing device for biomechanical CAD environments, is uniquely suited for applications in which the user frequently moves between desk work and virtual environment viewing, or in which high resolution views of the virtual environment are required, or in which the viewing device must be shared among collaborators in a group setting. The CCSV hardware encompasses a dual-CRT-based stereoscopic viewer with wide-angle optics, a video electronics box, a dedicated microprocessor system monitoring joint angles in the linkage, and a host computer interpreting sensor values and running the application which renders the right and left views for reader CRTs. O.C.

A91-41497

PARALLEL AXES GRAPHICS USING LINCOLN'S LOG METHOD AS AN ALTERNATIVE TO BINOCULAR PARALLAX GRAPHICS

DONALD B. CURTIS (AT&T Bell Laboratories, Denver, CO) and ROBERT P. BURTON (Brigham Young University, Provo, UT) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 172-181. refs

Binocular parallax graphics and parallel axes graphics are described and contrasted. With appropriate hardware, binocular parallax graphics can make effective, realistic three-dimensional images. Parallel axes graphics uses simpler hardware to render its images, which, though not life-like, present data without loss of information even in more than three dimensions. Binocular parallax graphics is superior for real-world objects; parallel axes graphics is superior for presenting information with more than three simultaneous variables. Binocular parallax graphics benefits from but often requires a substantial repertoire of cues and scan conversion techniques; parallel axes graphics uses fewer cues and maps naturally to the display surface. Binocular parallax graphics offers the advantages and pitfalls of familiarity; parallel axes graphics, in its developmental stage, precludes both.

Author

A91-41498

WIDE ANGLE ORTHOSTEREO

ERIC M. HOWLETT (Leep Systems, Pop-Optix Laboratories, Waltham, MA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 210-223. refs

The present evaluation of the optical viewing system used in nearly all existing head-mounted display (HMD) systems notes that, by comparison to video monitors, such HMD systems furnish a qualitatively different kind of access to remote or computer-generated reality. This difference is such that, even in the currently rather crude state-of-the-art, a revolutionary computer interface/real-time telepresence methodology appears to be at hand. The present discussion gives attention to the possibility that the HMD spatial presentation may sufficiently depart from 'orthospacial' verisimilitude to degrade the utility of such a system. O.C.

A91-41499* Naval Ocean Systems Center, Kailua, HI. STEREO ADVANTAGE FOR A PEG-IN-HOLE TASK USING A FORCE-FEEDBACK MANIPULATOR

EDWARD H. SPAIN (U.S. Navy, Naval Ocean Systems Center, Kailua, HI) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 244-254. NASA-supported research. refs

Copyright

An improved assessment methodology has been implemented

at NOSC and tested using an instrumented peg-in-hole (PIH) taskboard. Several aspects of the methodology are discussed in light of their implications for future studies of manipulator performance. Using a simple (but high-fidelity) force-feedback manipulator, a group of 9 trained operators showed a consistent advantage for stereoscopic TV viewing over monoscopic TV viewing when performing the PIH task. To introduce a controlled element of spatial uncertainty into the testing procedure, taskboard orientation relative to the manipulator and remote video camera head was changed in a randomized order on a trial-by-trial basis. The stereoscopic advantage demonstrated by this study can reasonably be expected to be even more pronounced as the quality of the stereo TV interface is improved and force-feedback provided through the manipulator system is diminished and/or distorted.

Author

A91-41500

REMOTE MANIPULATOR TASKS IMPOSSIBLE WITHOUT STEREO TV

ROBERT E. COLE, SUSAN FORE, PATRICK LESTER (Hawaii, University, Honolulu), and JOHN O. MERRITT (Interactive Technologies, Williamsburg, MA) IN: Stereoscopic displays and applications; Proceedings of the Meeting, Santa Clara, CA, Feb. 12-14, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 255-265. Pacific International Center for High Technology Research-supported research. refs

Remote manipulator simulations expressly devised to minimize object familiarity and monocular clues have been conducted in order to assess the benefits of stereoscopic vs monoscopic TV. Initial performance was greatly enhanced with stereo, as opposed to mono viewing; subsequent testing with a maze and a task that controlled motion cues replicated the superiority of stereo TV. Subjective scales and interviews of experimental subjects have deepened insight into the trial-and-error strategies developed by operators to overcome mono viewing-related performance problems: these strategies produced erratic, time-consuming operator movements. O.C.

A91-41542

THERMAL TESTING OF A 99 PERCENT PURITY MOLECULAR SIEVE OXYGEN CONCENTRATOR

G. W. MILLER and C. F. THEIS (USAF, School of Aerospace Medicine, Brooks AFB, TX) SAFE Journal, vol. 21, May-June 1991, p. 26-31. refs

The performance and product-gas composition of a molecular sieve oxygen concentrator are evaluated to determine the effects of high temperature and the presence of CO. The inlet air and absorbent beds are heated for performance runs under nominal and worst-case operating temperatures. When the absorbent-bed temperature is 297 K, the cycle time is 15 seconds, and the inlet air pressure is between 275.8 and 310.3 KPa, the concentrator performs optimally. The same is true for operating temperatures of 323 K and 338 K if the cycle time and inlet pressure are reduced. When the absorbent-bed temperature is 347 K, CO concentration achieved a maximum of 8.3 ppmv, the worst case for performance and purity. Cycle time and inlet pressure can be varied to optimize the performance of 99-percent-purity oxygen concentrators, and the worst-case operating bed temperature produced amounts of CO that are much lower than the maximum allowable concentration of 25 ppmv. C.C.S.

A91-42069

DYNAMICS OF THE SPACE STATION BASED MOBILE FLEXIBLE MANIPULATOR

V. J. MODI and J. K. CHAN (British Columbia, University, Vancouver, Canada) Acta Astronautica (ISSN 0094-5765), vol. 25, March 1991, p. 149-156. refs

(Contract NSERC-5-80029; NSERC-5-55380) Copyright

The governing equations of motion for the in-plane dynamics of the Space Station based manipulator with flexible links and

joints are presented. The hybrid equations, derived using the Lagrangian approach, are highly nonlinear, nonautonomous, and coupled. A linear dynamic model of the system is analyzed for the eigenvalues, corresponding to the natural vibration frequencies for the flexible system, as affected by the system configuration and loading. Results show the system frequencies to change by as much as 80 percent during a typical maneuver. On the other hand, in general, the linear response described the system performance satisfactorily with some disparity at higher frequencies. Author

A91-42990#

THE MICROTECHNOLOGY SECTION DEVELOPS A SCALE FOR ASTRONAUTS [MIKRO-TECHNIEK ONTWERPT ASTRONAUTENWEEGSCHAAL]

F. H. VAN DER LAAN Ruimtevaart, vol. 40, April 1991, p. 22-24. In Dutch.

The scale designed and built by the Microtechnology Section of the Technische Universiteit Delft to allow astronauts to measure their body mass is briefly described. The importance of weight monitoring for astronaut health and medical research programs is recalled; the problems of measuring body mass in microgravity are explained; and ESAs need for a smaller and more convenient scale than those previously used by Soviet and NASA astronauts is discussed. The present design comprises a simple platform with anchoring points for the feet, two hand grips attached by cloth strips and a window-shade-like mechanism (which also acts to release the platform to take a measurement), the measurement electronics, and an LCD display. Preliminary tests on a breadboard model during zero-g flights with an ESA Caravelle aircraft are considered promising, and space evaluation is recommended.

T.K.

A91-43332

DIAGNOSTIC EXPERT SYSTEMS FOR THE D-2 MISSION ROBOT EXPERIMENT - DEVELOPMENT OF AN AUTOMATED HEALTH AND FAULT MANAGEMENT SYSTEM [DIAGNOSE-EXPERTENSYSYSTEM FUER DAS ROBOTER-EXPERIMENT DER D-2-MISSION - ENTWICKLUNG EINES AUTOMATISCHEN 'HEALTH AND FAULT MANAGEMENT'-SYSTEMS]

HELMUT NIEDERSTRASSER and CLAUS-DIETER STRUBE (DLR, Institut fuer Flugfuehrung, Brunswick, Federal Republic of Germany) DLR-Nachrichten (ISSN 0937-0420), May 1991, p. 36-41. In German.

Copyright

A monitoring and diagnostic system for the Spacelab Mission D-2 robotic microgravity experiment is described. The structure and special characteristics of the system are examined and its expert system is considered. It is shown how the system can make qualitative judgments concerning the cause of systemic problems and how the automated Health and Fault Management System is used to localize defects. Block diagrams of the expert systems are shown.

C.D.

A91-43925

CLOSED-LOOP BEHAVIOR OF A FEEDBACK-CONTROLLED FLEXIBLE ARM - A COMPARATIVE STUDY

SABRI CETINKUNT and WEN-LUNG YU (Illinois, University, Chicago) International Journal of Robotics Research (ISSN 0278-3649), vol. 10, June 1991, p. 263-275. refs

Copyright

The closed-loop pole-zero pattern of finite-dimensional models is compared to the infinite-dimensional model under the same realistic feedback controllers, to determine the accuracy of the pinned-free and clamped-free mode shape approximations. Formulations are presented of the infinite-dimensional transcendental transfer functions for a flexible beam, made without any modal approximation, and finite-dimensional transfer functions with different shapes and numbers of modes. It is concluded that the closed loop bandwidth requirements in the order (or higher) of one half to two thirds of the lowest cantilever natural frequency

of the beam require active joint stiffness so that the joint is sufficiently stiff and resembles the clamped, rather than pinned, boundary condition. O.G.

N91-25602# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

OCULAR HAZARDS IN FLIGHT AND REMEDIAL MEASURES

May 1991 121 p In ENGLISH and FRENCH Symposium held in London, England, 22-26 Oct. 1990 (AGARD-CP-492; ISBN-92-835-0616-2) Copyright Avail: NTIS HC/MF A06; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The operational use of contact lenses by military aircrew, cataract surgery and intra-ocular lenses, the correction of refractive errors by radial keratotomy, impairment of color vision in ophthalmologists using argon lasers, and the medical management of combat laser eye injuries are examined.

N91-25606# Institute of Aviation Medicine, Farnborough (England).

AIRCREW SUNGLASSES

D. H. BRENNAN In AGARD, Ocular Hazards in Flight and Remedial Measures 6 p May 1991

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The hazards of light are now better understood and it is imperative that aircrew, who may fly in ambient illuminance levels reaching 150,000 lux or greater, be provided with adequate protection. The primary hazards are from the CIE (International Commission on Illumination) photobiological bands starting at the ultra violet-B and extend through to the infrared-A although the latter is relatively unimportant. Potentially the most serious hazard is from the visible band below 500 nm; these highly energetic photons constitute the blue light hazard to the retina. The spectral transmittance of a sunfilter must take into account these hazards while at the same time not adversely affecting color discrimination. A good sunfilter should not only protect the eyes but also improve visual acuity and contrast discrimination both in haze and glare conditions. Author

N91-25607# Army Medical Research and Development Command, Fort Detrick, MD.

LASER PROTECTION WITH IMAGE INTENSIFIER NIGHT VISION DEVICES

DAVID J. WALSH In AGARD, Ocular Hazards in Flight and Remedial Measures 7 p May 1991

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Current military ranging and targeting technology employs high power laser systems which can seriously damage the retina of the eye. Based on eye anatomy and function, three critical central retinal regions which must be protected - fovea, macula, and peripapillary zone (1 to 2 degree annulus surrounding the optic disc) - are included in a circular area with a 25-degree radius. In the aviation community, barrier-type laser protection inherent with night vision devices (NVDs) was thought to be adequate. The NVD barrier protection exceeds the recommended 25 degree minimum only when the eyes are in the primary (straight ahead) position. With normal scanning eye movement, critical areas of the retina become exposed to laser damage. Continuous laser protection for the central retina will require either a mechanical obstruction or a laser protective spectacle or visor which covers at least 90 degrees. The mechanical laser protection provided by NVD wear alone is not adequate to protect the aviator. Author

N91-25609# British Aerospace Public Ltd. Co., Bristol (England). Human Factors Dept.

THE EFFECTS OF DAZZLE AND DAZZLE GENERATED AFTERIMAGES ON AIMING AND TRACKING PERFORMANCE

A. KELVIN DAVIES In AGARD, Ocular Hazards in Flight and Remedial Measures 8 p May 1991 Sponsored in part by

Ministry of Defence, England

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A series of experiments was designed to collect data for the modeling of aiming and tracking performance during and after dazzle exposure. Compensatory tracking performance was measured for static targets and targets moving with a constant linear velocity using a laboratory based tracking simulator. Tracking error was recorded with a bright noncoherent dazzle source overlaid on the target and with target-dazzle separations of 0.5, 1.0, 2.0, and 3.0 degrees. There was an indication that the dazzle source caused a significant deterioration in tracking performance. Tracking errors were inversely related to the separation between target and dazzle source and were at a maximum when target and dazzle were coincident. The effects of dazzle may persist for a significant time after dazzle offset. Foveal afterimages measuring 1 degree were generated by brief exposure to an intense light source. Tracking error with an afterimage was recorded and compared to the errors recorded for normal foveal vision, and those arising when tracking using regions of the retina 2, 4, and 6 degree peripheral to the fovea. A significant deterioration in tracking performance was evident with an afterimage. Comparable results were obtained when tracking using the peripheral retina at 4 to 6 degrees. This similarity is attributed to observers offsetting their gaze so as to image the target away from the non-functioning foveal receptors. A significant learning effect was indicated.

Author

N91-26693# Joint Publications Research Service, Arlington, VA.
HIGHER PLANTS AS PART OF BIOLOGICAL HUMAN LIFE SUPPORT SYSTEM Abstract Only

I. YE. IVANOVA, T. A. DERENDYAYEVA, T. P. ALEKHINA, and YU. I. SHAYDOROV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 2 18 Apr. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya and Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 4, Jul. - Aug. 1990 p 40-43
Avail: NTIS HC/MF A05

The functional characteristics of a man-plant-mineralization system were studied using higher plants that perform a photoautotrophic role with Chlorella in a biological life support system. Wheat, peas, carrots, beets, cabbage, etc., were hydroponically cultivated in a winter garden and periodically given nutrients. The plants were cultivated for 6 months at 22 - 25 C, 55 - 70 percent relative humidity, with 24-hour per day lighting of 60 - 80 W/sq m for the vegetables and 125 - 185 W/sq m for the wheat. The plants demonstrated maximum productivity during days 70 - 100 of the experimental period, when mineralization products, dying of organic waste, and human and algal waste products all acted on the plants. The increase in the edible biomass of all the vegetables except the carrots was less than in the control group. Calculations of the vegetable contents of sugars, cellulose, ascorbic acid, and carotene (carrots only) demonstrated a 2.5-fold increase in vitamin C content in carrots, and a 2.2-fold increase in vitamin C and fructose in beets, with a 2-fold decrease in glucose and sucrose in the latter. The cellulose content of the peas also decreased by 13 percent. These results demonstrated that higher plants and Chlorella are compatible in a common atmosphere. It was also shown that the nutritive solutions given to the plants did not increase plant productivity. The reasons for the low productivity of the plants in a closed system remain inexplicable and thus require further study.

Author

N91-26745# National Inst. for Occupational Safety and Health, Cincinnati, OH.

PHYSIOLOGICAL RESPONSES TO THE WEARING OF PROTECTIVE EQUIPMENT AND RESPIRATORS: EFFECTS OF HOT, HUMID INSPIRED AIR ON WORK OF BREATHING Final Report

N. L. TURNER 1990 39 p
(PB91-152884) Avail: NTIS HC/MF A03 CSCL 05/8

The physiological effects of breathing cool/dry, cool/humid, hot/dry, and hot/humid air were observed during rest, and during light and moderate intensity exercise on a cycle ergometer. Nine

male volunteers, 18 to 35 years old, took part in four 50-minute submaximal exercise tests under the four different inspired air conditions. The results demonstrated several positive effects of hot air breathing on lung mechanics. Dynamic lung compliance was increased with both hot/dry and hot/humid air breathing during rest and exercise. These increases in compliance implied a decrease in the inspiratory work of breathing, although no statistically significant decreases were demonstrated. Frequency of breathing was decreased and tidal volume increased with hot air, allowing a more efficient breathing pattern. These results lent support to the current inspired air temperature criteria for SCBA certification, as set for in 30 CFR, Part 11 and proposed 42 CFR, Part 84. The study suggests that future research in the area include a study in which both inspired air and ambient air temperature are varied. The possibility of interactions between hot inspired air and hot ambient air should be explored as closed circuit respirators used in both fire fighting and hazardous waste operations may be used under hot ambient conditions.

Author

N91-26746# GEOMET Technologies, Inc., Germantown, MD.

AIRLINER CABIN ENVIRONMENT: CONTAMINANT MEASUREMENTS, HEALTH RISKS, AND MITIGATION OPTIONS Final Report, Dec. 1988 - Dec. 1989

N. L. NAGDA, R. C. FORTMANN, M. D. KOONTZ, S. R. BAKER, and M. E. GINEVAN Dec. 1989 310 p

(Contract DOTS59-89-C-00082)

(PB91-159384; GEOMET-IE-2096; DOT-P-15-89-5) Avail: NTIS HC/MF A14; also available SOD HC \$19.00 as 050-000-00531-3 CSCL 06/11

The purpose of the study was to develop information to be used for determining health risks from exposure to environmental tobacco smoke (ETS) and other pollutants for airliner occupants. Selected ETS contaminants (nicotine, respirable suspended particles, and carbon monoxide) as well as ozone, microbial aerosols, carbon dioxide, and the other environmental variables were measured in different parts of airliner cabins for 92 randomly selected smoking and nonsmoking flights. In assessing mitigation strategies, a total or partial ban on smoking provided the greatest benefit at least cost. Exposure management was the only viable option for reducing risks due to cosmic radiation. For removal of CO₂, sorption on solid, regenerative absorbent beds was considered to be a method with potential benefits.

Author

N91-26747* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

METHOD AND APPARATUS FOR WASTE COLLECTION AND STORAGE Patent

WILLIAM E. THORNTON, JR., inventor (to NASA) and HENRY B. WHITEMORE, inventor (to NASA) 9 Apr. 1991 15 p Filed 10 Aug. 1989 Division of US-Patent-Appl-SN-035401, filed 7 Apr. 1987

(NASA-CASE-MSC-21025-3; US-PATENT-5,005,457; US-PATENT-APPL-SN-392174; US-PATENT-APPL-SN-035401; US-PATENT-CLASS-83-206; US-PATENT-CLASS-83-203; US-PATENT-CLASS-83-277; US-PATENT-CLASS-83-282; US-PATENT-CLASS-83-614; US-PATENT-CLASS-83-649) Avail: US Patent and Trademark Office CSCL 06/11

A method and apparatus are disclosed for collection of fecal matter designed to operate efficiently in zero gravity environment. The system comprises a waste collection area within a body having a seat opening. Low pressure within a waste collection area directs fecal matter away from the user's buttocks and prevents the escape of undesirable gases. The user actuates a piston covered with an absorbent pad that sweeps through the waste collection area, press the waste against an end of the waste collection area and retracts, leaving the used pad. Multiple pads are provided on the piston to accommodate multiple uses of the system. Also a valve allows air to be drawn through the body, which valve will not be plugged with fecal matter. A sheet feeder feeds fresh sheets of absorbent pad to a face of the piston with each actuation.

Author

N91-26748# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
AN ADVANCED KNOWLEDGE AND DESIGN ACQUISITION METHODOLOGY: APPLICATION FOR THE PILOT'S ASSOCIATE Final Report, Feb. - Oct. 1990
 MICHAEL D. MCNEESE, BRIAN S. ZAFF, KAREN J. PEIO, DANIEL E. SNYDER, and JOHN C. DUNCAN Dec. 1990 234 p
 (Contract AF PROJ. 7184)
 (AD-A233700; AAMRL-TR-90-060) Avail: NTIS HC/MF A11 CSCL 12/7

This report documents the creation, development, and evaluation of an advanced knowledge and design acquisition methodology. The methodology develops user requirements along three separate yet integrated perspectives: (1) intuitive/experiential knowledge, (2) structural/functional models, and (3) knowledge as design. Three specific tools to implement perspectives; concept mapping, IDEF modeling, and design storyboarding are discussed. An integrative structure is proposed as an interactive way to let users and other design team members assimilate, deepen, and combine knowledge for the purpose of developing intelligent systems and human machine interface designs. Hence, system designs are directly derived from user engineering and from user conceptualization and participation. The project applies this methodology to the Pilot's Associate program which resolves complex knowledge acquisition/representation requirements. Results indicate that pilots could successfully reveal their own comprehension of an air to ground mission and transform this conceptual knowledge into actual designs for an intelligent pilot vehicle interface. The ability of this methodology to elicit multiple knowledge perspectives and to preserve them in an integrated form (which facilitates interaction with new domain experts in the future) creates an effective means for all phases of the system design. GRA

N91-26749# California Univ., Los Angeles.
EXPERT SYSTEM EXPLANATION: THE USER PERSPECTIVE Research Report, 1 Jun. - 31 Oct. 1990
 ANAT JACOBY Oct. 1990 37 p
 (Contract N00014-86-K-0395; NR PROJ. RR0-4206)
 (AD-A233739) Avail: NTIS HC/MF A03 CSCL 12/5

To understand how to tailor expert system explanation to users, a study was conducted that examined the relationship of goals and explanations to two types of task performance. It was predicted that students receiving goals, explanations, and tasks with highest congruence, would perform best. Fifty-three high school students were randomly assigned to one of two explanation groups or a control group. All groups received the same goal of replicating a scheduling task. All groups received a sampled schedule, and the explanation groups received, in addition, one of two explanations, a retrospective-trace explanation or a reconstructive-justification explanation. The retrospective-trace explanation provided the detailed steps of how to construct a schedule; the reconstructive-justification explanation provided justification of a given schedule. All groups received two tasks, given in random order: a replication task of producing a schedule and a verification task of verifying the correctness of a schedule. GRA

N91-26750# Army Aeromedical Research Lab., Fort Rucker, AL.
SPH-4 AIRCREW HELMET IMPACT PROTECTION IMPROVEMENTS 1970-1990 Final Report
 RONALD W. PALMER Feb. 1991 43 p
 (AD-A233784; USAARL-91-11) Avail: NTIS HC/MF A03 CSCL 05/8

The Sound Protective Helmet-4 (SPH-4), a derivative of the Navy SPH-3, has been used by the Army since 1970. As the knowledge of crash environments and human impact tolerance has increased through analyses of aircraft accidents and laboratory research, the performance of the standard SPH-4 helmet has been continuously reappraised, and the helmet's shell, liner, retention, earcups, and suspension have been upgraded to provide more impact protection. This report includes a discussion of

improvements made in the SPH-4 helmet and the effects these improvements have had on its performance. The SPH-4, SPH-4B, and HGU-56/P are compared in terms of major design features, impact protection, and retention capabilities. The development of helmet impact testing methodology used at the U.S. Army Aeromedical Research Laboratory, Fort Rucker, Alabama, also is discussed. GRA

N91-26751# Analysis and Technology, Inc., New London, CT.
EVALUATION OF NIGHT VISION GOGGLES FOR MARITIME SEARCH AND RESCUE Interim Report, Mar. 1989 - Sep. 1990
 W. H. REYNOLDS, R. Q. ROBE, G. L. HOVER, and J. V. PLOURDE Aug. 1990 112 p
 (Contract DTCG39-89-C-E10G56)
 (AD-A233798; USCG-D-01-91) Avail: NTIS HC/MF A06 CSCL 17/5

Experiments were conducted to evaluate night vision goggles (NVGs) for their effectiveness in detecting small targets at night. Three types of NVGs were evaluated: the AN/AVS-6 Aviators Night Vision Imaging System (ANVIS) NVG was tested onboard Coast Guard HH-3 and CH-3 helicopters, and the AN/PVS-5C and AN/PVS-7A NVGs were tested onboard 41-foot Coast Guard utility boats. During the spring 1990 experiments, simulated persons in the water wearing orange personal floatation devices, retroreflective tape, and either a green personnel marker light or a red safety light; 4- and 6-person life rafts with and without retroreflective tape; and 18- and 21-foot white boats were employed as targets during realistically-simulated search missions. A total of 1355 target detection opportunities were generated for the above-mentioned target types during four experiments. These data were analyzed to determine which of 25 search parameters of interest exerted a statistically-significant influence on target detection probability. Lateral range curves and sweep width estimates are developed for each search unit/target type combination. Human factors data are presented and discussed. Recommendations for conducting NVG searches for small targets are provided. GRA

N91-26752# Army Natick Research and Development Command, MA.
NOTIONAL HELMET CONCEPTS: A SURVEY OF NEAR-TERM AND FUTURE TECHNOLOGIES Final Report, Oct. 1989 - Sep. 1990
 HENRY GIROLAMO Mar. 1991 60 p
 (AD-A234475; NATICK/TR-91/017) Avail: NTIS HC/MF A04 CSCL 14/2

This research identified, explored, and evaluated near-term and future technologies having potential applications in developing a future helmet-mounted display and an integrated battlefield communication/information management system that will enhance the dismounted soldier's performance. This report was written with the combat developer in mind and is intended to serve as a technology guide. Helmet-mounted displays would have a multi-purpose full-face shield capable of displaying alphanumeric data and graphics. It would need a polycarbonate resin that would provide protection against ballistic fragmentation and directed energy hazards. The display would include night vision enhancement capabilities and electro-optical weapon sights for remote weapon sighting; sensors to medically monitor the soldiers physiological functions; and sensors that would warn soldiers of chemical and biological agents, radiation, and other hazardous atmospheric conditions. GRA

N91-26753# Department of the Navy, Washington, DC.
REGENERATION OF WHETLERITE FOR ADSORBING TOXIC POLLUTANTS FROM AIR Patent Application
 VICTOR R. DEITZ, inventor (to Navy) 13 Dec. 1990 12 p
 (AD-D014859; US-PATENT-APPL-SN-627163) Avail: NTIS HC/MF A03 CSCL 24/1

This invention relates to a method of regenerating adsorbents for removing toxic pollutants from air. More specifically, it relates to a method of restoring the ability of metal oxide-impregnated activated carbon referred to as whetlerite to remove cyanogen

chloride from air. Whetlerites are activated carbon-based composites impregnated with ammoniacal solutions of divalent copper and monovalent silver, with or without hexavalent chromium, in various concentrations. Optionally, triethylenediamine (TEDA) is added to prolong the service life of the absorbent and resist the adverse effects of humid environments. Whetlerites adsorb a wide variety of toxic air pollutants, in particular cyanogen chloride, cyanogen, and hydrogen cyanide. GRA

N91-26754# Army Aeromedical Research Lab., Fort Rucker, AL.

VISUAL AND FIELD-OF-VIEW EVALUATION OF THE M-43 PROTECTIVE MASK WITH PRESCRIPTION EYEPIECES Final Report

JOHN K. CROSLY, CLARENCE E. RASH, and RICHARD R. LEVINE Mar. 1991 37 p
(AD-A234592; USAARL-91-13) Avail: NTIS HC/MF A03 CSCL 23/2

The U.S. Army Aeromedical Research Laboratory was requested by the proponent of the 43 aviator protective mask to conduct a laboratory study of the visual performance of flight AH-64 Apache helicopter pilots wearing masks with 'glue-on' prescription lenses. In response, several visual functions tests were conducted including: high and low contrast visual acuity, heterophoria, fixation disparity, and stereopsis at both near and far. In addition, visual field losses of the integrated helmet and display sighting system were examined. Performance in the corrective mask was compared to that with habitual correction, either spectacles or contact lenses. The results of the visual functions tests indicated acceptable performance on all the measures except fixation disparity. The high degree of variability found on this test suggested problems associated with the prescription lens optical design, namely its high radius of curvature and its additional thickness. Field-of-view results indicated losses in visual field above those obtained with spectacle correction, but comparable to that found with the plano mask. GRA

N91-26755# Naval Health Research Center, San Diego, CA.
EFFECT OF A PASSIVE COOLING VEST ON TENSION/ANXIETY AND FATIGUE IN A HIGH HEAT AND HIGH HUMIDITY NAVAL ENVIRONMENT Interim Report, Jun. - Oct. 1989

RALPH G. BURR, GUY R. BANTA, J. T. COYNE, JAMES A. HODGDON, and CHARLES V. CHESSON, II 16 Oct. 1990 27 p
(AD-A234657; NHRC-90-23) Avail: NTIS HC/MF A03 CSCL 06/10

Crewmembers aboard U.S. Navy ships in the Persian Gulf theater of operations are subjected to continuous heat strain. During the months of July and August, it is not unusual for this part of the world to reach ambient temperatures in the range of 120 to 130 F with the relative humidity up to 90 pct. Previous field studies on U.S. Navy ships in the Persian Gulf have shown crewmembers have difficulty falling asleep at lights out, poor quality sleep, falling asleep on the job, physical and psychological fatigue, and feelings of confusion and tension/anxiety. Exposure to heat has also been shown to affect performance capabilities during sustained work. Grether (1973) reported that human performance of such tasks as time estimation, reaction time, vigilance, tracking, and other skilled cognitive operations, show performance decrement in ambient temperatures above 85 F. GRA

N91-26756# Systems Research Labs., Inc., Dayton, OH.
ADVANCED DYNAMIC ANTHROPOMORPHIC MANIKIN (ADAM) DESIGN REPORT Final Report, Feb. 1985 - Jun. 1989
AILEEN M. BARTOL, VERNON L. HAZEN, JOSEPH F. KOWALSKI, BRIAN P. MURPHY, and RICHARD P. WHITE, JR. Mar. 1990 672 p
(Contract F33615-85-C-0535)
(AD-A234761; AAMRL-TR-90-023) Avail: NTIS HC/MF A99 CSCL 05/8

The USAF has embarked on a new effort to design and develop an Advanced Dynamic Anthropomorphic Manikin (ADAM) with

improved biofidelity and instrumentation over currently available escape system test manikins. This report described the design of three prototypes (one small, one mid-size, and one large) instrumented, anthropomorphic manikins for testing, evaluating, and qualifying high-performance aircraft escape systems, including restraint and harness systems. Among the required responses are that it provide a human-like reactive live load into the ejection seat and possess realistic dynamics and kinematics due to windblast, impact vibration, and acceleration forces representative of those encountered during ejection from an aircraft. In addition to improved biomechanical response properties, the manikin has instrumentation and an on-board data acquisition system to measure, store, and transmit its responses and the data form the escape system. Two prototype manikins, a small and a large, will be fabricated and tested at Wright-Patterson AFB, OH. GRA

N91-26757# Anacapa Sciences, Inc., Fort Rucker, AL.
TASK ANALYSIS AND WORKLOAD PREDICTION FOR THE MH-47E MISSION AND A COMPARISON WITH CH-47D WORKLOAD PREDICTIONS. VOLUME 2: APPENDIXES A THROUGH N Final Report, Dec. 1988 - Aug. 1990

CARL R. BIERBAUM and DAVID B. HAMILTON Mar. 1991 450 p
(Contract MDA903-87-C-0523; DA PROJ. 2Q2-63007-A-793)
(AD-A235249; ASI690-329-90-II-VOL-2; ARI-RN-91-35-VOL-2)
Avail: NTIS HC/MF A19 CSCL 05/9

For this research, a mission scenario was used to conduct a comprehensive task analysis for MH-47E operations. The analysis used a top-down approach to identify the phases, functions, and tasks for the mission and identified 5 phases, 15 segments, 73 functions, and 239 tasks. The crew member performing each task was identified, and estimates of the sensory, cognitive, and psychomotor workload associated with the tasks were derived. Estimates of the task durations also were derived. The mission/task/workload analysis data were used to develop a computer model of workload for MH-47E crew members. The model used a bottom-up approach to build mission functions from tasks and mission segments from functions. Decision rules were written to specify the procedure for combining the tasks into functions and the functions into segments. The model permitted an analysis of total workload experienced by the pilot and copilot in the performance of both sequential and concurrent tasks. The predicted workload for the MH-47E pilot and copilot was compared to the CH-47D baseline workload prediction to determine the impact of the advanced technology on the MH-47E. The comparison indicated little difference in the predicted workload for the pilot and indicated a lower predicted workload for the copilot in the MH-47E. Volume 1 of the report describes the methodology and summarizes the results of the research. This volume contains the appendixes, which present the workload predictions of the CH-47D. GRA

N91-26758# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

EFFECTIVENESS OF ICE-VEST COOLING IN PROLONGING WORK TOLERANCE TIME DURING HEAVY EXERCISE IN THE HEAT FOR PERSONNEL WEARING CANADIAN FORCES CHEMICAL DEFENCE ENSEMBLES

B. BAIN Jan. 1991 11 p
(AD-A235273; DCIEM-91-06) Avail: NTIS HC/MF A03 CSCL 05/8

Effectiveness of a portable, ice-pack cooling vest (Steelevest) in prolonging work tolerance time in chemical defense clothing in the heat (33 C dry bulb, 33 percent relative humidity or 25 C WBGT) was evaluated while subjects exercised at a metabolic rate of approximately 700 watts. Subjects were six male volunteers. The protocol consisted of a 20 minute treadmill walk at 1.33 m/s and 7.5 percent grade, followed by 15 minutes of a lifting task, 5 minutes rest, then another 20 minutes of lifting task for a total of one hour. The lifting task consisted of lifting a 20 kg box, carrying task for a total of one hour. The lifting task consisted of lifting a 20 kg box, carrying it 3 metres and setting it down. This was followed by a 6 m walk (3m back to the start point and 3 m back to the box) in 15 sec after which the lifting cycle began again.

The work was classified as heavy as previously defined. This protocol was repeated until the subjects were unable to continue or they reached a physiological endpoint. Time to voluntary cessation or physiological endpoint was called the work tolerance time. Physiological endpoints were rectal temperature of 39 C, heart rate exceeding 95 percent of maximum for two consecutive minutes of visible loss of motor control or nausea. The cooling vest had no effect on work tolerance time, rate of rise of rectal temperature or sweat loss. It was concluded that the Steelest ice-vest is ineffective in prolonging work tolerance time and preventing increases in rectal temperature
GRA

N91-26759* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

INVESTIGATING COMBUSTION AS A METHOD OF PROCESSING INEDIBLE BIOMASS PRODUCED IN NASA'S BIOMASS PRODUCTION CHAMBER

T. W. DRESCHER, R. M. WHEELER, C. R. HINKLE, J. C. SAGER, and W. M. KNOTT May 1991 21 p Prepared in cooperation with Bionetics Corp., Cocoa Beach, FL
(Contract NAS10-11624)
(NASA-TM-103821; NAS 1.15:103821) Avail: NTIS HC/MF A03 CSCL 06/11

The Controlled Ecological Life Support System (CELSS) Breadboard Project at the John F. Kennedy Space Center is a research program to integrate and evaluate biological processes to provide air, water, and food for humans in closed environments for space habitation. This project focuses on the use of conventional crop plants as grown in the Biomass Production Chamber (BPC) for the production and recycling of oxygen, food, and water. The inedible portion of these crops has the potential to be converted to edible biomass or directly to the elemental constituents for direct recycling. Converting inedible biomass directly, by combustion, to carbon dioxide, water, and minerals could provide a baseline for estimating partitioning of the mass balance during recycling in a CELSS. Converting the inedible biomass to carbon dioxide and water requires the same amount of oxygen that was produced by photosynthesis. The oxygen produced during crop growth is just equal to the oxygen required to oxidize all the biomass produced during growth. Thus, the amount of oxygen produced that is available for human consumption is in proportion to the amount of biomass actually utilized by humans. The remaining oxygen must be available to oxidize the rest of the biomass back to carbon dioxide and water or the system will not be a regenerative one.
Author

N91-26760 Tel-Aviv Univ. (Israel). Dept. of Interdisciplinary Studies.

SITTING POSTURE ANALYSIS. AN EXPERIMENTAL OPTIMISATION APPROACH M.S. Thesis

RAM BARNEA Apr. 1989 88 p In HEBREW; ENGLISH summary
(ITN-91-85114) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

An instrumented chair was developed and used for the automated acquisition and processing of data on contact pressure distribution and its variation with posture. A pressure distribution coefficient was defined which facilitated the evaluation of the effect on contact pressure distribution of variations in sitting plane inclination, back rest inclination and vertical height of the sitting plane. The sitting plane and back rest inclinations ranged from 0 to 12 degs to the horizontal and vertical, respectively, and the sitting plane height varied from 38 to 44 cm above the footrest. Measurements involving 6 subjects indicated that the optimum pressure distribution was obtained for sitting and back plane angles of 0 and 12 degs, respectively, and seat height of 44 cm. The maximum local contact pressure, of 240,000 pascal, was obtained for both angles of 0 degs and seat height of 38 cm. The data analysis techniques developed could be applied to seat posture and to clinical diagnosis and treatment of sitting posture disorders.
ISA

N91-27093* Mary Hardin-Baylor Univ., Belton, TX. Dept. of Mathematics and Physics.

AN AIR REVITALIZATION MODEL (ARM) FOR REGENERATIVE LIFE SUPPORT SYSTEMS (RLSS) Final Report

MAXWELL M. HART In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 1 15 p Dec. 1990
(Contract NGT-44-005-803)

Avail: NTIS HC/MF A10 CSCL 06/11

The primary objective of the air revitalization model (ARM) is to determine the minimum buffer capacities that would be necessary for long duration space missions. Several observations are supported by the current configuration sizes: the baseline values for each gas and the day to day or month to month fluctuations that are allowed. The baseline values depend on the minimum safety tolerances and the quantities of life support consumables necessary to survive the worst case scenarios within those tolerances. Most, if not all, of these quantities can easily be determined by ARM once these tolerances are set. The day to day fluctuations also require a command decision. It is already apparent from the current configuration of ARM that the tighter these fluctuations are controlled, the more energy used, the more nonregenerable hydrazine consumed, and the larger the required capacities for the various gas generators. All of these relationships could clearly be quantified by one operational ARM.
Author

N91-27096* South Carolina Univ., Columbia. Dept. of Computer Science.

INCORPORATION OF SHUTTLE CCT PARAMETERS IN COMPUTER SIMULATION MODELS Final Report

TERRY HUNTSBERGER In Houston Univ., NASA/ASEE Summer Faculty Fellowship Program, 1990, Volume 1 12 p Dec. 1990
(Contract NGT-44-005-803)

Avail: NTIS HC/MF A10 CSCL 05/8

Computer simulations of shuttle missions have become increasingly important during recent years. The complexity of mission planning for satellite launch and repair operations which usually involve EVA has led to the need for accurate visibility and access studies. The PLAID modeling package used in the Man-Systems Division at Johnson currently has the necessary capabilities for such studies. In addition, the modeling package is used for spatial location and orientation of shuttle components for film overlay studies such as the current investigation of the hydrogen leaks found in the shuttle flight. However, there are a number of differences between the simulation studies and actual mission viewing. These include image blur caused by the finite resolution of the CCT monitors in the shuttle and signal noise from the video tubes of the cameras. During the course of this investigation the shuttle CCT camera and monitor parameters are incorporated into the existing PLAID framework. These parameters are specific for certain camera/lens combinations and the SNR characteristics of these combinations are included in the noise models. The monitor resolution is incorporated using a Gaussian spread function such as that found in the screen phosphors in the shuttle monitors. Another difference between the traditional PLAID generated images and actual mission viewing lies in the lack of shadows and reflections of light from surfaces. Ray tracing of the scene explicitly includes the lighting and material characteristics of surfaces. The results of some preliminary studies using ray tracing techniques for the image generation process combined with the camera and monitor effects are also reported.
Author

SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A91-41214

**EVOLUTION OF MATTER IN THE UNIVERSE AND THE
ORIGIN OF LIFE ON EARTH [EVOLIUTSIIA VESHCHETVA
VO VSELENNOI I PROISKHOZHDENIIE ZHIZNI NA ZEMLE]**

MARKUS D. NUSINOV (AN SSSR, Institut Kosmicheskikh
Issledovani, Moscow, USSR) and VENIAMIN I. MARON
(Moskovskii Institut Nefti i Gaza, Moscow, USSR) Priroda (ISSN
0032-874X), April 1991, p. 26-31. In Russian. refs

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This paper discusses the evolution of matter in the universe, the hierarchy of structures in the organization of matter, the information volume in these structures, and informational evolution. It is shown that, when the number of atoms in a molecular system of organisms at various stages of evolution is plotted as a function of cosmic time (i.e., the period between 10 to the 13th and 10 to the 20th years, which includes the cosmological, chemical, biological, and postbiological stages of evolution) a maximum is reached at 10 to 11th atoms/molecule (in man). The mechanism and the environment necessary for the formation of viruslike structures in montmorillonite particles are described together with the conditions necessary for the formation of viruses not dependent on residence in the clay, resulting in the first forms of living organisms. I.S.

A91-42322

**FLAVOPROTEINOIDS IN PROCESSES OF PREBIOLOGICAL
EVOLUTION [FLAVOPROTEINOIDY V PROTSESSAKH
PREDBIOLOGICHESKOI EVOLIUTSII]**

M. P. KOLESNIKOV (AN SSSR, Institut Biokhimii, Moscow,
USSR) Akademiia Nauk SSSR, Izvestiia, Seria Biologicheskaiia
(ISSN 0002-3329), May-June 1991, p. 325-333. In Russian. refs

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Several proteinoids of the type described by Heinz and Ried (1981) were prepared by heating glycine-enriched dry mixtures of amino acids. They were shown to catalyze some photooxidation and photoreduction reactions and the photophosphorylation of ADP. The proteinoids were found to contain a flavinlike pigment. The pigment was isolated from the mixture and was characterized by means of fluorescence and IR spectroscopy analyses. It is suggested that photochemical reactions with the participation of flavoproteinoids could have evolved in the course of chemical evolution, leading to the emergence of photosynthesis in living cells. I.S.

A91-42381* Geological Survey, Flagstaff, AZ.

**MARS ELYSIUM BASIN - GEOLOGIC/VOLUMETRIC ANALYSIS
OF A YOUNG LAKE AND EXOBIOLOGIC IMPLICATIONS**

D. H. SCOTT and M. G. CHAPMAN (USGS, Flagstaff, AZ) IN:
Lunar and Planetary Science Conference, 21st, Houston, TX, Mar.
12-16, 1990, Proceedings. Houston, TX, Lunar and Planetary
Institute, 1991, p. 669-677. refs

(Contract NASA ORDER W-15814)

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Geologic, physiographic, and topographic data on the Elysium Basin on the Martian lowland plains are used to determine the former volume of water in the basin and the sources of this water. The maximum extent of the paleolake was estimated to be about 2,000,000 sq km, with a water volume of 850,000 cu km or more, supplied to the basin from many sources in the highlands via inflow channels. The climatic and biological implications that the Elysium-Basin sea or lake might have had are discussed. I.S.

A91-43072#

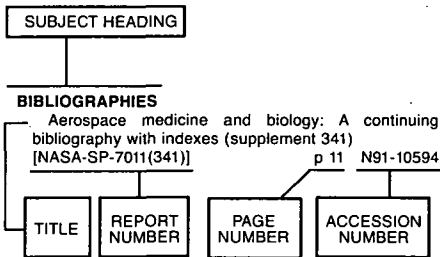
**LIFE ON PLANETS IN OTHER PLANETARY SYSTEMS?
[LEBEN AUF PLANETEN ANDERER SONNENSYSTEME?]**

REINHARD W. SCHLOEGL (Max-Planck-Institut fuer Biophysik,

Frankfurt am Main, Federal Republic of Germany) Sterne und
Weltraum (ISSN 0039-1263), vol. 30, July 1991, p. 426-428. In
German.

The evolution of life from prebiotic substances via a self-organization process is discussed, and the possibility of such a process occurring in other planetary systems is addressed. It is argued that the existence of higher lifeforms elsewhere in the universe is highly probable. The potential for communicating with such lifeforms is considered. C.D.

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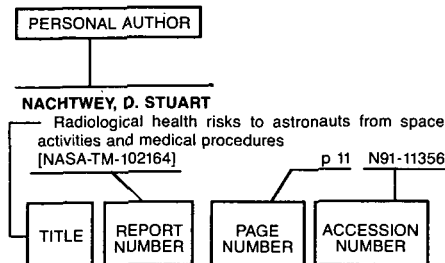
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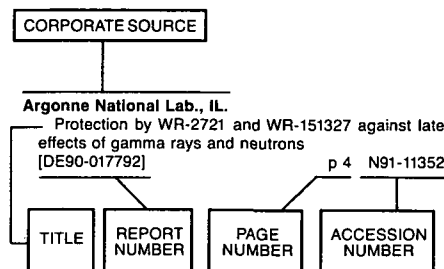
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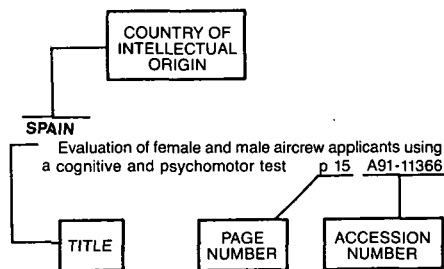
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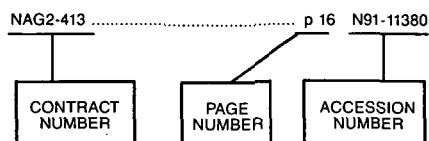
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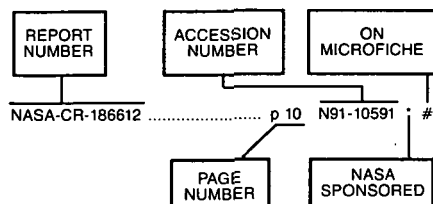
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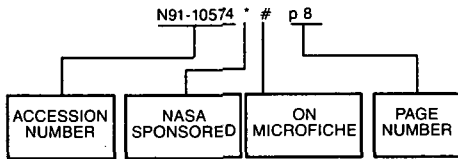
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